LIBRARY OF CONGRESS
JAN 4 1892
13556

THE AMERICAN GAS LIGHT JOURNAL

REDMAN & KENNY, N.Y.

PUBLISHING OFFICE No. 32 PINE STREET

DEVOTED TO THE INTERESTS OF ILLUMINATION, VENTILATION, WATER SUPPLY AND DISTRIBUTION, & GENERAL SCIENCE.

VOLUME LVI.—No. 1. Whole No. 865. | NEW YORK, MONDAY, JANUARY 4, 1892. | $3 PER ANNUM, IN ADVANCE.

A. M. CALLENDER & CO., Proprietors. C. E. SANDERSON, Manager.
JOS. R. THOMAS, C.E., Editor. T. J. CUNNINGHAM, Asst. Editor.

ENTERED AT THE POST OFFICE AT NEW YORK, N. Y., AS SECOND CLASS MATTER.

Published on each Monday of the year, at No. 32 Pine Street, N. Y.

Terms of Subscription, Including Postage.—For the United States and Canada, $3 per annum. European countries, $4.50 (19 shillings—22½ francs). All payments to be made in advance. Single copies, 10 cents.

Remittances should be made either by post-office order, express money order, registered letter, or bank draft on New York, payable to the order of A. M. Callender & Co.

Collections are invariably made directly from this office, for subscriptions, advertisements, etc. We have agents to solicit the same, but they are not authorized to receipt for money.

The American News Company, Nos. 39 and 41 Chambers street, New York, are agents for this JOURNAL. Newsdealers will send orders to them.

Correspondence.—Wishing to make this JOURNAL a gazette of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, correspondence is solicited for publication from all who make the study of those subjects a pleasure or a profession.

Books.—We will forward by express, at publisher's lowest rates, any book—scientific or otherwise—to any address in the United States or Canada. We would suggest to our patrons that to avoid the risk and expense consequent on sending us the money (we do not send books C.O.D.), that orders for books be sent us through the Purchasing Department of the American Express Company.

CONTENTS.

An Asterisk (*) denotes an illustrated article.

EDITORIALS—

Briefly Told 1
The old Year and the New—And There was no Discrimination.
The Market for Gas Securities 2
The Effect of the Fly Wheel on an Exhauster Engine, by Mr. Fred. Egner 2
The Jurors' Report on Gas Lighting Apparatus at the French Exhibition 3
Oil Fuel under Stationary Boilers 4
Gas versus Steam Power 5
Something about Petroleum and Natural Gas in Foreign Countries. 6
Some Practical Disadvantages Incidental to the Generation and Distribution of Electricity to Consumers, by Mr. Norton H. Humphrys—Continued from page 922, Vol. LV. 6
Notes on Estimating, by Mr. D. W. King 7
Boiler Firing 7
*The Rose Fuel Gas Process 8
The Economic Limit of Large Power Units 9
ITEMS OF INTEREST FROM VARIOUS LOCALITIES 11
New Shops of the Detroit Dry Dock Engine Company—Something about the Jacksonville (Ills.) Company—Mr. W. Humphreys Present Address—A Suit at Seattle, Wash.—Betterments at Tyrone, Pa.—Mr. Harris and His Prior Adventures—Bachelor Fitz Teaches the Benedicts—Mrs. Linger and the Crust—Betterments at Alton, Ills.—Death of Mr. H. G. Lewis—Good-bye to Fuel Gas, Akron, Ohio—The Citizens Gas Company, of Denver—More about the Seattle Suit—The Louisville Company not at Fault—Some Personals—And Other Items.
Explosions in Manufactories of Brown Coal Briquettes 13
CORRESPONDENCE—
That is the Question 13

BRIEFLY TOLD.

THE OLD YEAR AND THE NEW.—With this number the JOURNAL begins its Fifty-sixth Volume, and our most pleasing task in connection with this announcement is to congratulate the fraternity upon the volume and completeness of the evidence before us in proof of the solid condition of the gas industry. At no other time in the history of American gas lighting has the record of a single year been so uniformly encouraging, so positively assuring. Our midsummer output figures prepared us to receive a still more satisfactory showing for the winter half of the year, but from the statistics so far obtained we have the solid satisfaction of *knowing* that, marked as was the increase for the first half of the year, the remaining half will outrank it in most positive manner.

This will be a satisfactory New Year's gift to the gas men and to ourselves; and we desire to here express our appreciation of and our hearty thanks for the warm support given us by the fraternity in the first year of the last decade of the nineteenth century. The JOURNAL may differ with some in respect to the methods and policy that should govern the maintenance and spread of the industry that we are all concerned in, and while it did not in the past, nor in the future shall it, refrain from speaking its own opinion in respect to the shifting issues of the day or time, it has only to repeat that whatever is said by it is dictated solely by a desire to advance and sustain the dignity of the profession as a body, without regard to individuals or without inquiry as to what particular personal interests are trenched upon. To put it plainly, the JOURNAL is for the gas industry, first, last and between times.

Even as the gas makers themselves are to be congratulated over the advance of 1891, so also are the suppliers of apparatus to be congratulated and complimented on the busy time they enjoyed in the season just closed, and on the excellence of the work that they delivered and erected. It goes without saying that an improvement in product is always, at least partly, the result of an improvement in the designing and manufacturing of the apparatus in which the product is finished, and it is certainly reassuring to know that the designers and constructors of gas works apparatus are fully abreast of the advanced lines of the gas engineers.

Harking back over two score and more of years may be likely to evoke only a small echo, but the engineer who now views, with a pride that sometimes is even shaded into wonder, the leviathan gasholders—the very disgruntled gas consumer looks upon some of these examples with awe—that dot the land, may be pardoned for going back to about the year 1848, when the first telescopic gasholder (New York works, uptown station, the second holder at which was constructed by Messrs. J. W. & J. F. Starr) on the 2-lift order that was entirely worked out and constructed in the United States, was put in action. Surely, the art of the gas maker and craft of the constructor have gone and are going hand in hand. As it is with the gasholders so also is it in the other division—carbonizing and finishing apparatus, governing and distributing appliances—improvement in planning, care in selection of material, and nicety in finish, mark the work of the manufacturers.

We are glad to be able to congratulate our associates over the fact that they have had a prosperous old year, and are better pleased yet to felic-

itate them on the brightness of the new year that opens its treasure days to them.

In conclusion, we hope that those who receive our circular of inquiry for the record of the past six months will respond to it without delay.

AND THERE WAS "NO DISCRIMINATION."—As has been remarked many a time, "There's nothing like leather," but the assertion, despite its antiquity, does not appeal with great force to the tanner whose leather has been rejected. Hence, from that standpoint, it would seem that "there is leather and *leather*," and from the standpoint of the World's Fair Commissioners there is nothing in the lighting field than electricity, although the Commissioners by their latest action confess that "there is electricity and *electricity*." Our present reference to the subject is caused by an editorial, printed in the Western *Electrician*, dated December 26, in which our contemporary refers to a circular that was published some time ago in Philadelphia at the instance of certain gentlemen interested in the sale of gas appliances. That circular urged upon the gas men of the country the policy of causing the various representatives in Congress, that could be reached by the gas companies, to oppose the loan of $5,000,000 that the Commissioners will ask at the hands of the United States, unless adequate recognition of the gas industry be given. We are not in sympathy with this proposition; on the broad ground that the Fair, having now become a matter of National concern, should be given that support by the whole country and all of its industries, which the fair fame of the United States demands. And in this we do not abate one jot from our position that some of those connected with the management of the Fair are, to say the least, rather blind in their attitude towards the lighting of the buildings, and in their treatment of an industry that—direct and allied—represents many hundreds of millions of capital, on which dividends are earned and paid. Our contemporary mentioned above naturally feels cut up at the suggestion to "insulate" the Congressmen, wherefore the "nothing like leather" reference would seem to apply, as might fairly be inferred from our contemporary's lines. Some of these are: "This is an unpleasant exhibition of sulkiness, and is sure to defeat its own ends. Electricity was chosen as the agent for illumination at the World's Fair grounds, not as one of several possible methods, but as the only possible method. The Managers could not do without it, and have a Fair worthy of this age and of this Nation. Every fair-minded person must recognize this. There was no discrimination against gas whatever, as the latter was never seriously considered as a general illuminating agent for the grounds and buildings." Here is richness! There never was no Mrs. Harris, and as Mrs. Harris never existed, there was no discrimination against her when someone that looked like her humbly asked for recognition for a chance to show that she was in the flesh only to be indiscriminately refused. Our contemporary may take it for granted—and we will call its attention to the fact that there are 5 gas burners in Chicago to-day for each electric lamp that it can unearth in its own city—that the Fair Managers will come down from their electric roost eventually and ask for a partial supply of gas, as a "certain means" of assisting in causing the Fair to become worthy of this age and Nation—although it will likely not be supplied under the terms offered by Chief of Construction Burnham in his late proposition to the World's Fair Committee, of the American Association. That there are grades in the electric quality of leather is shown by the recent determination of Electricity Chief, Mr. Sargent, who has arranged it so that every "electrical firm in the country of any prominence will have a chance or opportunity to show what it can do in the way of lighting, etc." It seems that something like 50 specific contracts will be offered, under which arrangement each tanner can perform his tanning according to the separate practice of his tannery. Discrimination, indeed! No, only a dividing of the favors.

The Market for Gas Securities.

The feature this week was the upward movement in Consolidated gas which shows a gain in the interval of last writing of 4 points—opening sales to-day (Thursday) having been made at 103½. It sold up to 104½ yesterday. The closing price last year was 94½ so investors have had all the best of it. Our advice is as before, hold your shares, never paying great heed to the market rates. The Company is stronger now than at any prior period of its history. Standard common is in some demand, at 36 to 40, but the preferred is neglected at 81 to 85. Over in Brooklyn Citizens gas more than maintains the advance reported a week ago, and the other shares are dull and strong. In out-of-town shares the feature as usual was Chicago gas, which opened at 71½ to-day. Laclede common is a trifle firmer, at 20½ to 20¾, and Baltimore consolidated at 43¾ looks a purchase. It might be added that the net gain in Chicago gas for the year is 37½ points.

The Effect of the Fly Wheel on an Exhauster Engine.

By MR. FREDERIC EGNER.

Have you ever thought upon the relation of the usual heavy fly wheel, which we see scarcely without exception on exhauster engines, to the duties which the exhauster engine governor is expected to perform? Perhaps you have; but the makers of these machines seem never to have wasted much time on that subject, or else we would not, in the advertising cuts of makers of exhausters, see the useful apparatus depicted with a fly wheel, which in the reality always is found fully up to the illustration referred to. The object of a fly wheel is to correct the irregularities of motion of the engine crank, by its momentum. In calculating the proper weight of the fly wheel of an engine, reference is had to the maximum power the engine is expected to exert, or the load it must move. If the engine is made to drive a sawmill, the weight of the rim of the fly wheel is calculated to be the resident of force equal to six, and even more, times the power developed by the engine in one-half stroke. Such a rule is very good for a large factory, or an engine driving electric—especially incandescent—light dynamos, where the greatest regularity in motion is an essential feature; but it is the reverse of useful in an exhauster engine, where the load not only varies every few minutes in the 24 hours of the day, and where—and now, stop and think—the speed of the exhauster is also expected to change to a little faster or slower, in order that the pressure in the gas mains may be maintained at a set point, notwithstanding that the load—that is, volume of gas to be pumped—is continually changing. And the load does vary, if we pump from the hydraulic main, a "relief holder," or the street mains, to supply a distant holder station—that we all know. There would seem to be hardly an excuse for one writing up such an elementary subject, if it were not for the fact that makers of gas exhauster engines still persist in furnishing, and users continue to accept, the useless, detrimental, heavy fly wheel in connection with the apparatus named. If the exhauster was to revolve with the same unvarying speed so desirable in an incandescent light dynamo or factory engine, we would have heavy back pressure at one time, vacuum at another, and all the intermediate stages in the interim, within our retorts, generators, or mains from which we might be pumping; and we all agree without argument that that would be very bad practice. But if this were not so, and an even speed was that which was wanted, then the ordinary ball, or any other steam governor, and the fly wheel would be sufficient for the purpose, hence there would be no need for any of the ingenious gas-actuated exhauster engine governors in use. The necessity for, and usefulness of, the latter kind of governors no one would think of questioning, and yet everybody continues, without question, to use the heavy fly wheel which cannot help but to retard, in fact, almost destroy, the effect of the governor, be it ever so good a one.

Any well made exhauster engine governor will, and is expected to, increase or diminish the steam supply to the engine, when acted upon by even so small a difference of pressure as $\frac{1}{18}$ of an ounce per square inch. Then, to suppose that the speed of the exhauster shall be affected by such a delicate movement of the steam valve as the above implies, when the motion of the engine is retarded or accelerated by a heavy fly wheel, is to expect the impossible! This was apparently recognized by the inventor of the "Compensator," which, when kept in order, will counteract the detrimental action of the (in exhauster engines) worse than useless heavy fly wheel, at the expense of some power and much needless wear of apparatus. It may be here interesting to remark that, with the aid of a good compensator, the author was able to employ a gas engine with entire success to drive a large gas exhauster for some years. With the gas engine for any purpose, the heavy fly wheel is, of course, a necessity, whereas with the steam exhauster engine it is out of place, because the weight and momentum of the exhauster blades are sufficient to carry the engine crank over the dead centers, and to make up for the irregularities in motion of the same at certain portions of its stroke. In practice the action of a heavy fly wheel in connection with the exhauster engine governor will be about this way. For example: Suppose, in a coal gas works, a few retorts are freshly charged. The increase in volume of gas produced will immediately cause the governor to open the steam valve of the engine, so that it may move faster and take away the gas as made, keeping the pressure in the retorts and hydraulic main at the most desirable point, as previously arranged. Now the inertia of the heavy fly wheel comes into play; because, before the engine will have been able, in response to the first slight opening of the steam valve, to speed up the retarding action of this heavy wheel causes the governor to open the steam valve too much, the engine will go faster than was required, in the first place, and, before the average reg-

ular speed is regained, the engineer, with hand on the throttle, will very likely have had to take a hand in it to steady things.

In all these statements the author relates only the everyday experience of those who have given these matters their personal attention, and although the young gas engineer may find in these lines some information, upon points which the author hopes may be of use to him, to the older members of the profession this article contains nothing new. Is it, therefore, not surprising that the heavy fly wheel in connection with the exhauster engine governor is still seen? If the old heads who have grown gray in the business would only consent occasionally to give to the profession some of the wrinkles which years of experience have taught them, how much the knowledge of gas making might be advanced. And this could be done without in the least injuring the old gas engineers, superintendents, or managers, and to the certain benefit of that profession of which we are so proud to be considered useful members. With an example of personal experience in the matter treated of by the author will close this article.

Some four years ago, having occasion to use an exhauster for the purpose of daily supplying from the street mains a large gasholder, we employed for that work a No. 9 Roots' exhauster, with engine on same bed plate. After trying the machine the usual heavy fly wheel was removed, taken to the shop, and trimmed down to less weighty proportions. For ten days that exhauster was run without any fly wheel or substitute therefor, and for turning the engine over the dead centers in starting, a pair of large chain tongs were used, applied to the engine shaft. During all this time the action of the exhauster was perfect, and the pressure gauge did not show a variation of the half of one-tenth of an inch. The importance of the steady, even working of an exhauster in any situation, need, of course, not be explained. The fly wheel mentioned, reduced to a nicely turned hand wheel of large diameter, was finally replaced; and that is all that any exhauster engine ever requires, and this only as a help to the engineer. Like experience has been had, using the MacKenzie, and the Wilbraham exhausters or blowers, from the smallest to the largest sizes. The results are always bound to be the same; namely, prompt response of the engine to the to be expected action of the exhauster engine governor. Engineers who are troubled by irregular action of the exhausters will do well to make a note of these facts, and it is furthermore hoped that makers of these machines will be pleased to drop the old detrimantal heavy fly wheel on exhauster engines, thereby saving metal and freight, and making their apparatus more efficient in the bargain.

[From the London Journal.]

The Jurors' Report on Gas Lighting Apparatus at the French Exhibition.

Through the kindness of M. Cornuault, the well-known Engineer and ex-President of the Societe Technique du Gaz en France, we have received a copy of his official report upon the exhibits in Class 27 of the Paris Exhibition of 1889, which comprised apparatus and arrangements for lighting (not electrical). This publication, which is issued by authority of the Ministry of Commerce and Industry, forms one of a series of Jury Reports complied under the direction of M. Picard, Reporter General for the Exhibition, which constitute a complete record of the exhibits at the last great "Exposition Universelle Internationale," and are consequently valuable books of reference for technicians of all classes. Whatever may be the character of the other reports, which we have not seen, we have no hesitation in stating that M. Cornuault's work is a credit to the author and to French gas engineering science, and accordingly deserves a place in every gas engineer's technical library. It contains a mass of useful information, clearly arranged and intelligently criticized; and many of the author's observations upon gas burners are of particular value. Without pretending to enable readers of the *Journal* specially interested in the subject to dispense with the original, we may give a general idea of the nature of this exhaustive report.

The author introduces his subject with the remark that "the lighting industry interests the whole human race;" but he mercifully spares his readers the ancient history of artificial lighting—saying, indeed, that "lighting, properly so called, is one of the special conquests of the nineteenth century." He dates modern progress in the production of artificial light from the invention of the Argand oil lamp, samples of which, he states, were first shown in public on April 29, 1784, at the Comedie Francaise. The Argand lamp was improved by Carcel and Gagneau; and in 1836 it became, in the hands of Franchot, the "moderator" lamp, which persists to this day as the best arrangement for burning heavy vegetable oils. True to his nationality, M. Cornuault ascribes the invention of gas lighting to Lebon; but he admits that the early days of this new industry were particularly troublous, and that it was not before 1830 that gas lighting was really established in France, with the result of transforming the conditions of public and private lighting in the country. To the period 1830–40 M. Cornuault assigns another great advance in lighting—the production by de Mielly of of the stearine candle, or *bougie*, which gradually displaced the earlier *chandelle*, or torch, of wax for the rich, or of tallow or resin for the poor. It is worthy of remark that, although the English word "candle" is etymologically the same as the French word *chandelle*, it does not mean the same thing when it occurs in technical writings. Popularly, the French speak of *chandelles* just as English people do of candles; but to a French gas engineer the modern mould candle in not a *chandelle*, but a *bougie*. From 1840 to 1860, lighting developed upon the old lines, according to M. Cornuault, without new inventions. This was an age of consolidation of gas companies. From 1860 to 1870 mineral oil lamps became popular, thanks to the exploitation of the American petroleum fields. In 1878 a great change came over the industry of artificial lighting, through the appearance of the electric arc upon a commercial footing. Thenceforward conditions that actually exist put themselves in evidence; and all kinds of artificial lighting received a great impetus, which is yet far from being exhausted. The importation of petroleum into France has doubled during the last ten years; and the production of gas has also increased by 50 per cent. In gas lighting the salient feature of this decennial period is the appearance of the recuperative gas lamp, due to the genius of Frederick Siemens, the principle of which has been largely adopted, especially in England. M. Cornuault concludes his introductory remarks with the following eloquent passage: "The rapid review thus given suffices to show the path traversed during the century. The need for light grows unceasingly; there will never be enough sources of light to satisfy the increasing requirements of modern civilization. The field to be exploited is boundless; the progress of the electric lighting during the last period (of ten years) has intensified the general demand, and developed, to the advantage of all, the lighting effect due to other sources of illumination."

After this, M. Cornuault divides his task into three parts, devoted respectively to lighting by vegetable oils, by mineral oils, and by gas. With the first two sections of the report we are not much concerned. The employment of vegetable oils for lighting purposes diminishes yearly; the moderator lamp being reserved as a luxury for the rich, and no attempt being made to improve it in any other than the artistic sense. It is recorded that, whereas in 1855—that is to say before the appearance of mineral oil and the popularization of gas—the consumption of colza oil in Paris was after the rate of 5.870 kilos. per head of the population, in 1889 it had sunk to 2.580 kilos. Moreover, the acreage of France devoted to the cultivation of oil bearing plants is fast diminishing; and we may be sure that this falling off in the consumption of colza would be still more apparent but for its continued use for lighting railway carriages.

With regard to the consumption of petroleum in France, which, in 1889, attained to 184,101,000 kilos., M. Cornuault remarks that it has never halted in its development after the rate of 11 to 12 per cent. per annum, from the year of its first introduction, which is a rate of growth greatly exceeding that of gas, at least in recent years. The reason for this is stated to lie in the fact that the distribution of petroleum is on different lines from that of gas. Unlike gas, petroleum is as available for lighting the most isolated house as the town mansion. It therefore goes everywhere; while hardly one third of the population of France lives within reach of gas. It is observed that this growing popularity of mineral oil in France is in despite of the discouragement of heavy import duties and *octroi*, which amount together, in the case of Paris, to a charge of 0.416 francs per litre. In the country, where the commodity is less taxed, it commonly sells at from 40 cents to 50 cents per litre, which is double the usual price in Belgium.

M. Cornuault gives many interesting particulars concerning the designs and performances of different kinds of mineral oil lamps. Speaking of the Hinks Duplex lamps, which are by him qualified as the first order of mineral oil lamp *de luxe*, it is recorded that photometrical tests made at the Gas Pavilion of the exhibition, under the direction of M. Sainte-Claire Deville, gave for a continuous six hours' trial a mean hourly consumption for a lamp of this kind of 78 grammes of oil, for a mean illuminating power of 2.14 carcels. The mean consumption of oil per carcel-hour was, therefore, 36.4 grammes. These lamp tests were all made for the same period of six hours; the lamps being weighed and the light measured every hour. In the case of the Duplex lamp, the illuminating power increases (say) from 2.10 carcels when first lit, to 2.50 carcels at the end of the third hour, after which it

rapidly falls to 1.62 carcels. Before quitting the subject of lamps, M. Cornuault notices those of the "Lucigen" type, of which he highly approves for certain purposes, and he further remarks upon the great and increasing popularity of oil cooking stoves.

When he comes to the subject of the gas industry in France, M. Cornuault, as may be supposed, fairly overflows with statistical data; for a French engineer is nothing if not a statistician and a mathematician. The report shows that, in the ten years 1878-1888, the gas consumption of France increased by 62 per cent., while that of Paris in particular increased by 42 per cent.; the growth of population for the same period being only 18 per cent. Although this means that the consumption of gas in Paris per head of the population had attained to 110 cubic meters in 1888, M. Cornuault admits that this figure is far inferior to that applying to the consumption of gas in London, which he takes at 150 cubic meters per head; the total consumption in the British capital being in excess of that of the whole of France. There is thus plenty of scope for the French gas industry, not merely with reference to what may be calculated to represent the point of saturation of the community for artificial light, but also with respect to the English standard of gas popularization. It is to be feared, however, that the higher cost of gas in France, as compared with English rates, will somewhat hinder the development of the French gas industry.

Proceeding to the consideration of the gas burners shown in the Exhibition of 1889, the reporter points out that the previous Exhibition of 1878 had only contained one example of a high-power burner—this being a Sugg's triple-ring Argand. All the other gas burners were of small power. In 1889 four classes of new gas lamps had to be formed—comprising, respectively, high-power lamps open to the air, recuperative lamps, incandescent lamps, and lamps for carbureted gas. The simple enumeration of lamp classes demonstrates how much activity has marked this particular branch of the gas industry during the past ten or twelve years. Discussing the high-power gas lamps open to the air, M. Cornuault declares that none has proved so successful as the Paris Gas Company's model known by the awkward title of the "Fourth of September lamp"—from the name of the street wherein these lamps were first shown in rivalry with Jablochkoff electric candles. It is necessary to remark that this is an example of the force of the adage which accuses every crow of thinking her own young the whitest, because, as a matter of fact, the lamps in question are never seen out of France, and are rare outside Paris.

M. Cornuault has, of course, a good deal to say about the *rationale* and performance of recuperative lamps, the first idea of which he traces to a Frenchman—Chaussenot—who is reputed to have introduced the double-chimney Argand for the purpose of supplying the flame with hot hair, at some vague period referred to as "more than half a century ago." This is loose language for a severely scientific report. If Chaussenot did make the first double-chimney Argand, why are not as full and precise particulars of its production given as in regard to the appearance of the original Argand oil lamps? Although M. Cornuault insists upon the validity of Chaussenot's claim to fame, we are not at all disposed to grant it to him until better evidence in point is supplied. M. Cornuault admits, however, that Frederick Siemens made the first recuperative gas lamp; and, while conceding the excellence of the performance of these arrangements with lateral chimneys, he remarks that the recuperative principle did not become truly popular out of Germany until the original design of Siemens had been turned upside down, so as to produce a shadowless light. The report states that, after this signal change, the recuperative gas lamp was improved by many skilful hands, without modification of the principle. The leading varieties are then explained.

After this comes the most original part of the report, consisting of a critical examination of the method of determining the mean spherical illuminating power of recuperative gas burners, which was practiced in the laboratory of the Gas Pavilion of the Exhibition by M. Sainte-Claire Deville, assisted by MM. Salanson and Brisac. The point developed by this criticism is explained as follows: "Luminous intensity is a property of elementary ray; and it is only by a very common laxity of language that one speaks of luminous intensity of a lighting apparatus. This confusion had no inconvenient results while the burners in use belonged to the Argand or the flat-flame types, because the diffusion over a sphere of radius unity being practically equal for all such burners, the total quantity of light emitted by them may be considered as sensibly proportional to the intensity of the horizontal ray, which is the only one actually measured. It is not so with recuperative burners. Knowledge of the luminous intensity of the horizontal ray, or even of any ray whatever taken by itself, is absolutely insufficient to indicate the total quantity of light emitted by the lamp." This conception is expounded in several pages of the report. It means practically that when the light given by different recuperative burners is measured in a determinate variety of directions—say, nine in all, as in M. Sainte-Claire Deville's tests—it is found to vary considerably. The partizans of these lamps naturally prefer to rate them at their best; but M. Cornuault argues that the mean spherical duty is the fairest datum whereon to compare this kind of lamp with open flames and with one another. So tested, they do not differ to any great extent in their duty, nor do they so far surpass the simpler forms of burner as appears to be the case where the measurements are taken in one particular direction. Moreover, the best effects of all are not given in the same direction, which is an important consideration in determining the most suitable pattern to adopt for a particular purpose. The report contains an elaborate set of tables and plates exemplifying this aspect of the question of lighting by gas.

M. Cornuault also has something to say about gas cooking and the ventilation of gas-lighted apartments; but this notice of his report cannot be further extended. We can, therefore, only repeat our expression of admiration of the way in which the work has been done by the experienced and fair-minded reporter, who has made a really useful addition to the literature of the gas industry.

Oil Fuel Under Stationary Boilers.

The *Safety Valve* has secured a statement of results from those who have been using various types of oil-feeding apparatus for this purpose. Out of a total of 35 users distributed over the country who furnished our contemporary with their experiences with oil fuel, only three have abandoned it, and these because situated close to the coal mines, where coal or its refuse is to be had for scarcely more than the cost of carting it away. The first of these, an iron company of Sharpsville, Pa., discarded oil, and now use gases from their blast furnace for raising steam; the limited amount of fuel required in addition being more economically supplied by the cheap coal of the vicinity. The second, a salt company, of Le Roy, N. Y., say that in estimating the difference in cost between oil and coal, they weighed all the coal used under one of their 150 horse power boilers for 15 days, which proved to be 110½ gross tons of hard coal dust costing $1.70 per gross ton. They then put in two oil burners and burned one tank of oil. It lasted 180 hours steady burning and cost two cents the gallon. This they calculated made the cost of oil 88 cents per hour and coal a little more than 52 cents per hour. Then they tried a better type of oil burner and did still better, but it could not compete with coal at $1.70 a ton.

The third was an iron works company, of Erie, Pa. They use the cheap slack coal of the vicinity, and oil fuel could not, they found, compete with it. Against this thirty-two witnesses appear, not, of course, so favorably situated for cheap coals. Few of them seem to have adhered to the type of oil-feeding apparatus they started with, but all have had such success with oil fuel from an economical standpoint as to lead them to pin their faith to it.

A rolling machine company, of Fitchburg, Mass, say their oil fuel costs them 10 per cent less than coal or coke and that they save from 25 to 50 per cent. in time and make similar gains in point of production. A maker of mowers and reapers, of Akron, O., says oil fuel costs him not much, if anything, over one-third what he used to pay for coal. The oil is stored in a large underground tank located close to the railway track, and is drawn from this tank and fed to the burners by a small rotary pump. It saves him what used to be a large cost for labor, handling coal and ashes, and he no longer needs a fireman. A bicycle making concern, of Hartford, Conn., say that the use of oil in their furnaces has resulted in very largely increasing their product with a less number of men.

A drop-forge works, of Gloucester, Mass., do not find any difference between the cost of coal and oil, but "the oil fuel needs no attention, once it is started, and will run all day without ashes, clinkers," etc.

A bicycle manufacturer, of Toledo, O., says he is unable to speak as to the comparative cost of oil and coal fuels, as he never got anything like the amount of heat from coal that he is now getting from oil, but is sure that oil is the cheapest besides being more convenient and cleanly.

A steel company, of Steelton, Pa., finds no difference in cost between oil and coal, but saves largely in cost of labor.

A manufacturer of Plantsville, Conn., says: "In comparison with coal we save about 25 per cent., also gain from 10 to 20 per cent. more work in same time."

A maker of agricultural implements, of Clayville, N. Y., says he effects a saving of about 40 per cent. by the use of fuel oil in his furnaces instead of coal.

A bridge building company, of Toledo, O., pay one cent per gallon for oil delivered, the price of coal being $2.25 per ton. At these figures they find oil to be far cheaper.

An axle company, of South Egremont, Mass., do not find any difference between the cost of coal and oil, using the latter.

A saw company, of Middletown, N. Y., find oil fuel far cheaper than coal, and still more important to them, they get an intenser heat, the same being maintained steadily throughout the day, "thus," so they say, "improving the quality of our goods over that which it was possible to attain with coal as fuel. On the whole, we can say it is a grand success with us."

An agricultural implements company, of York, Pa., say: "We have made tests between oil, coal and coke. As bituminous coal is cheap here, there is no advantage in point of economy farther than the men can work more continuously and there is less lost time. We find oil fuel a good thing, all things considered."

A sand company, of Chicago, Ill., say: "We find it (oil fuel) very clean; it can always be regulated, always appears to be of uniform quality, and we find very little annoyance from its use, such as new grate bars and breakage of different kinds, which is always the case with the use of coal."

Gas Versus Steam Power.

Some months ago *Engineering* (Vol. LI., p. 453) gave the particulars of a very successful gas engine plant which had been carefully tested by Professor A. Witz. Stated briefly, though the brake horse power was but .69 the indicated horse power, the consumption of fuel was but 1.369 lbs. per indicated horse power per hour.

Recently the Severn Tweed Company, that operate the Cambrian Mills at Newtown, Montgomeryshire, England, replaced their steam engines by gas motors, using Dowson gas; and Mr. Dowson has forwarded to our contemporary particulars as to the resulting economy in working. In the latest instance the gas engine met with only an indifferent competitor, since the efficiency of the steam engine and boilers in use at these mills appears to have been very low, no less than 8 lbs. of slack coal, costing 8s. to 9s. a ton, being consumed per indicated horse power per hour. This figure, though by no means the highest on record, is poor enough to make the plant but ill adapted to compete with so economical a source of power as a gas engine operated with Dowson gas.

The mills in question are divided, so far as regards the distribution of power, into four sections, the machinery and approximating brake horse-power required being given by the following table.

The new motive power was installed at the beginning of the year and has been in continuous use ever since, thus showing that the economy of the gas motor is not obtained at the expense of an increased risk of breakdown. Trials of the engine were made both when anthracite and when coke were used in the producer, and the general results appear in Tables A and B. At the time of the trials, which it will be seen extended over 6 days (56 hours), the engines were working at one-third less indicated horse-power than their maximum, or even more favor-

TABLE A.—*Showing the Result of Working Six Days (56 Hours) with Dowson Gas, made from Welsh Anthracite, the Data being Furnished by the Severn Tweed Company, Limited.*

Number of Section.	Nominal Horse Power of Engine.	Approximate Maximum Brake Horse Power of Engine.	Approximate Brake Horse Power Used for Machines and Shafting During Trial.	Brake Horse Power Hours During Trial.	Fuel Consumed.			Cost of Fuel.			Remarks.
					Anthracite for Generator.	Slack for Boiler.	Total per Brake Horse Power per Hour.	Anthracite per Ton.	Slack per Ton.	Total per Brake Horse Power per Hour.	
1 and 4	60	128	96.03	5,377.75	lbs.	lbs.	lbs.	s. d.	s. d.	d.	The boiler was partly fired with anthracite cinders, etc., which fell through the generator grate bars.
2	40	73	72.39	4,054.00	13,416	336	1.23	19 10	9 6	0.13	
3	40	73	27.00	1,515.25							
Hoists	4	5½	3.57	200.00							
	144	279½	198.99	11,147.00							

TABLE B.—*Showing the Result of Working Six Days (56 Hours) with Dowson Gas made from Ordinary Gas Coke from the Gas Works, Wellington, the Data being Furnished by the Severn Tweed Company, Limited.*

Number of section.	Nominal Horse Power of Engine.	Approximate Maximum Brake Horse Power of Engine.	Approximate Brake Horse Power Used for Machines and Shafting During Trial.	Brake Horse Power Hours During Trial.	Fuel Consumed.			Cost of Fuel.			Remarks.
					Coke for Generator.	Slack for Boiler.	Total per Brake Horse Power per Hour.	coke per Ton.	Slack per Ton.	Total per Brake Horse Power per Hour.	
1 and 4	60	128	89.46	5,010.00	lbs.	lbs.	lbs.	s.	s. d.	d.	The coke was not of good quality. There was no residue from the coke in the generator, which could be used in the boiler.
2	40	73	66.12	3,702.72	16.645	1,568	1.73	15	9 6	0.135	
3	40	73	28.49	1,595.44							
Hoists	4	5½	3.57	200.00							
	144	279½	187.64	10,508.16							

Machines Used in Each Section, and Horse Power Required for Each Section.

Section No. 1.		Section No. 2.		Section No. 3.		Section No. 4.	
Description of Machine.	Approximate Brake Horse Power Required.	Description of Machine.	Approximate Brake Horse Power Required.	Description of Machine.	Approximate Brake Horse Power Required.	Description of Machine.	Approximate Brake Horse Power Required.
Blackman fan	2.50	6 twisting machines	18.00	40 fast looms	19.00	5 fulling machines	15.00
Wool drying machine	3.25	12 mules	24.00	47 slow looms	8.00	3 washing machines	3.00
Shaker	0.50	Warp hank machine	1.00	4 Sowden looms	.50	2 hydros	1.00
Burring machine	3.50	Reel hank machine	1.00	6 Bradford looms	.50	Wool scourer	3.00
New Willey	2.00	5 sets carding machines	30.00	4 winding machines	4.00	Stocks	.50
Old Willey	2.00	Shafting, etc.	6.00	Shafting	8.00	Shearing machine, etc.	5.00
Garnet machine	1.25					Tenter machine	6.00
8 sets carding engines	48.00					Shafting, etc.	4.00
2 sets waste engines	4.00						
6 mules	12.00						
Shafting, etc.	6.00						

able figures would be shown. Taking them as they stand, however, it appears that the fuel consumed when anthracite was used was only 1.23 lb. per brake horse-power per hour, which, if the internal friction of the engine is taken at 20 per cent., corresponds to barely 1 lb. per indicated horse-power per hour. The price of anthracite is at present rather high, but even at 20s. per ton the fuel bill only amounts to .13d. per brake horse-power per hour. In the trial with gas coke, which it appears was of poor quality, 1.73 lb. of fuel were used per brake horse power, corresponding to 1.4 lb. per indicated horse-power per hour. The coke cost 15s. per ton—a high figure—but in the Midlands the usual price is from 8s. to 10s. per ton, and in Glasgow there is, we are informed, a Dowson gas plant working successfully with coke costing 3s. 6d. per ton. Taking 10s. as an average price, the cost per brake horse-power per hour of the plant at the Newtown Mills would work out to .09d.

Something about Petroleum and Natural Gas in Foreign Countries.

Mr. W. Topley, in an article entitled "Sources of Petroleum and Natural Gas," with especial reference to these in countries other than America, remarks that the petroleum of Burmah occurs in the upper tertiary strata, probably of the age of the swalck formation in India. The oil occurs in soft sandy beds, covered by a stiff, blue clay, chiefly on the top of an anticline, the beds on each side dipping northeast and southwest, at angles up to 35°. The petroleum fields are those of Beme and Twingoung.

Along the Arakan coast, from Cheduba Island northwards, there are mud volcanoes with hydrocarbon gas. Petroleum there occurs at Boronga Island and Ramree Island. The rocks, of tertiary age, are crushed together and greatly folded. Wells have been drilled to a depth of over 1,200 feet; for a few weeks one well yielded 1,000 gallons daily, but the total production from 11 wells for a year was only 234,300 gallons. Petroleum also occurs in Pegu.

In Japan petroleum occurs in tertiary strata probably pliocene. The oil-bearing rocks are folded, with the axes of the folds running nearly northeast and southwest, the folds being frequently reversed; where so, the reversed dip is towards the neighboring seashore—to the northwest in Echigo, and to the southeast in Tootoomi. None of the wells flow, the oil being raised in buckets. The wells range up to over 700 feet in depth. The production in 1884 was about 4,750 tons; in 1882 it was nearly 3,530 tons. Petroleum has been recorded from Saghalien, the large island north of Japan.

Natural gas has long been known and utilized in China. It was discovered in sinking artesian wells for brine. There are borings for gas 3,000 feet deep in the district of Tsien-Lum Taing.

In New Zealand petroleum occurs on the east coast of North Island, at Poverty Bay, and at Waiapu, East Cape; borings to a depth of about 1,000 feet have been made. The rocks of these districts are cretaceous and tertiary.

On the west coast of North Island, at Sugarloaf Point, Taranaki (New Plymouth), a heavy oil oozes from cracks in a trachytebreccia; wells have been bored to a depth of many hundred feet, but no considerable supply has been obtained.

Considerable space is given to the Baku field, but, as the readers of this paper are aware, this region frequently has been described in these columns, and repetition is unnecessary. However, the following table of production of the Baku field, given on the authority of Mr. Redwood, may be interesting:

Year.	Tons.	Year.	Tons.
1863.....	5,484	1877.....	242,000
1864.....	8,700	1878.....	320,000
1865.....	8,900	1879.....	370,000
1866.....	11,100	1880.....	420,000
1867.....	16,100	1881.....	490,000
1868.....	11,900	1882.....	680,000
1869.....	27,180	1883.....	800,000
1870.....	27,500	1884.....	1,130,000
1871.....	22,200	1885.....	1,838,709
1872.....	24,800	1886.....	2,419,354
1873.....	64,000	1887.....	2,338,709
1874.....	68,000	1888.....	2,821,835
1875.....	94,000	1889.....	3,314,516
1876.....	194,000		

The most important area of the Caucasus, after Baku, in some respects, is that of Kouban. This lies at the northwestern end of the range. The wells here are usually of smaller depth, and are less productive than at Baku. Here, as at Baku, the heaviest oil sometimes comes from the highest beds.

The third productive area is near Kertch, in the Crimea. The wells here are not deep, and, compared with the two other districts, are not highly productive. One well, however, has been carried to a depth of 940 feet, and produced about 30 barrels per day for a time, its total production being about 3,500 barrels.

Around the Caucasus there are several other petroleum fields, which will rise in value when the highly productive district of Baku declines. Attempts have recently been made to work those near Batoum.

There are comparatively few petroleum areas in the interior of Russia; but oil has been noticed in the governments of Samara, Simbirsk, Kazan and elsewhere; it is also recorded from Petchora in Archangel. Silurian and Devonian rocks, often very fossiliferous, underlie large areas. These old rocks are but slightly disturbed, and it is possible of central Russia, being covered up by secondary strata, that in their anticlinal folds they may contain stores of gas and oil. So long, however, as the Caucasian petroleum fields are productive, there will be no great inducement to undertake expensive and perhaps fruitless exploration in new regions. In the future, however, it will be well to see if the conditions affecting the storage of palæozoic rocks of the United States and Canada are repeated in Russia.

[Continued from page 922, Vol. LV.]

Some Practical Disadvantages Incidental to the Generation and Distribution of Electricity to Consumers.

[Communicated by Mr. NORTON H. HUMPHRYS, A. M. Inst. C. E., F. C. S., to the London *Journal*].

It is sometimes remarked that no material is absolutely gas-tight; but gas engineers have been so fortunate as to meet with several that are practically so. Electrical engineers do not appear to have been quite so lucky in this respect; at least, so much may be inferred from the fact that some of them prefer to use conduits and insulated supports, the cost of which must be very considerable, rather than to "cover" the conductors with insulating matertal. With gas, the use of high-pressure trunk mains, involving also the employment of distributing stations filled with valves, governors, etc., for regulating the distribution, is applied on a limited scale, and that only to the very largest districts. But with electricity, the necessity for distributing stations appears to come in at a much smaller scale of operations. It is only possible to touch in a general way upon this point, because, as already remarked, it is really an open question. The high-tension and low-tension systems respectively have their advocates; and further experience will lead to the determination of fixed principles in this respect, as it has done in the case of gas.

In a paper dealing with the subject of generating and distributing electrical energy, recently read before the Institution of Civil Engineers by Mr. R. E. Crompton, it was stated that, with the low-pressure system, the efficiency of distribution should not be less than 90 per cent. At Kensington, 92 per cent. had been attained for the months of January, February and March, and 87 per cent. during the heaviest period of supply in December.

At St. James's, still better results had been recorded—94 per cent. being easily reached; and 97 per cent. had been maintained for a month. At Chelmsford, the result of a year's working with the alternating transformer system of distribution was an efficiency of 83 per cent. And the author gave several reasons for supposing that, with high-pressure systems and transformers, it might possibly be as low as 50 per cent.; but this could be greatly increased by manipulation of the transformers at sub-distributing stations. At this point one is naturally reminded of the system adopted at Cork—viz., the supply of electricity from sub-stations, where it is generated on a small scale by the medium of gas engines. This plan offers the advantage of doing away with the high pressure system and the transformers; and if a considerable loss by leakage is a necessary feature of that arrangement, so much the better for the scheme adopted by Mr. Denny Lane.

It is not necessary to go over the old story of the various circumstances that influence the percentage of unaccounted-for gas—such as the extent of the district and the consumption per mile of main, the variation in elevation, and the effect on the supply pressure, the use or otherwise of district gasholders with the necessary trunk mains, the number of consumers and the consumption per consumer, and similar matters, which have been discussed over and over again. The means by which it has been reduced from 20 or 30 per cent. down to 5 or 6 per cent., are generally well understood. In several respects, electricians

find themselves occupying a position akin to that held by conductors of gas undertakings some fifty years ago. They have a low consumption per mile of main, and a large variation between maximum and minimum supply. In the case of gas, the possibility of storage met this difficulty to some extent; whereas it appears that if electricians wish to enjoy the advantages of storage, they can only do so at some loss, to say nothing of a risk of failure. The gas generating and purifying plant need only be equal to the maximum *average* demand per 24 hours.

The distributing plant must, of course, be able to supply the maximum momentary consumption, which will probably obtain for an hour or two in the middle of the evening. If we suppose that the gasholders were not so sound and reliable as they are—that they always involved some loss by leakage, together with risk of total collapse—things would be different. If, instead of a generating and purifying plant equal to a little less than the average daily requirement just before Christmas, it was necessary to maintain one equal to the average *hourly* production, the price of gas would be double its present rate. Take as an example the consumption between 6 and 7 P.M. on Christmas Eve, and suppose that the manufacture had to keep step with it. The works would have to be twice as large as is now sufficient; and there would be an enormous addition to the working expenses, represented by a reserve of retorts kept ready for use, and men in waiting to serve them when required. That this is about the position of electricity at the present time is shown by the fact that Mr. Crompton points out that if the loss on storage is 20 per cent., and only one-fifth of the total production of electricity is allowed to pass through the accumulators, the actual loss is only 4 per cent. of the whole—a trifle as compared with the saving effected by the use of this form of storage.

(To be continued.)

Notes on Estimating.

By Mr. D. W. King.

In large engineering operations, when it is neeessary to haul the earth a long distance, it is more economical to use cars drawn by locomotives. The average speed of trains, including starting and stopping, is about 10 miles an hour, which is equivalent to 5 miles of lead per hour.

The loss of time for each trip, for loading and unloading, etc., is about 9 minutes, or 0.15 hour. Assuming that the wages of a laborer are $2 per day of 10 working hours, the cost of loosening and loading by shovelers the same as for carts; then—

Let T = the number of trips per train per day.
M = " " " hours in a working day = 10.
L = " " " five-mile lengths of lead in the distance the earth is to be hauled.
Y = the number of cubic yards in place removed per train per day.
c = the total number of cars in each train.
x = the total expense of each train per day.
X = the total cost per cubic yard of earth removed per train per day.

Then $T = \frac{M}{15 + L}$.

An ordinary dump-car will hold 1½ cubic yards of earth measured in place, and $Y = T \times c \times 1.5$, and $X = \frac{x}{Y}$.

The value of L is found by actual measurement, and is a known quantity. x is determined by computing the interest upon the cost of the train for one day, to which must be added the expenses of workmen, fuel, water, repairs, etc. For example, the cost of a locomotive is approximately $3,600; the cost of a train of 10 dump-cars is about $1,000, making a total of $4,600.

The interest upon $4,600 for one day at 6 per cent.....	$0 756
The wages of engineer and fireman.....	6 00
" " foreman at dump.....	2 50
" " three laborers, at $2.....	6 00
The cost of fuel for one day.....	2 00
" " water for one day.....	1 00
" " repairs on locomotive, 8 cars.....	3 00
Total expenses for one day.....	$21 256

The daily expense of track for interest and repairs may be estimated at $3 for each mile of lead or fraction thereof. Hence the expression, $X = \frac{x}{Y}$. To find the total cost X per cubic yard, exclusive of contractor's profits, add to the expenses, as demonstrated above, the cost of spreading the earth, superintendence, etc.

Spreading the Earth.—A bankman will spread a cubic yard of vegetable earth, sand, loam, etc., in 7.2 minutes; of clay, stony earth, etc., 11.4 minutes. He will trim the slopes of cuttings per superficial yard, if vegetable earth, sand, loam, etc., in 9 minutes. If clay, stony earth, etc., in 12 minutes.

The leveling and trimming of slopes of embankments, if of vegetable earth, sand, loam and civil, require 6 minutes; if clay or stony earth, etc., 8.4 minutes.

Filling in back of walls, etc., per cubic yard, if vegetable earth; sand or loam, will require 28.80 minutes; if clay, stony earth, etc., 33.00 minutes; if mud, 34.8 minutes.

Ramming the earth per cubic yard will require for vegetable earth, loam or sand, etc., in layers 6 inches deep, 24 minutes; if clay, stony earth, etc., layers 6 inches thich, 28 minutes.

Cutting and stacking the turf, say 3 inches thick, without removal, 8 minutes for each superficial yard. Resodding the same, 34.80 minutes per each superficial yard.

Keeping the Roads in Repair.—When carts and wagons are used to haul away the earth, the expense of keeping the roads in repair, such as filling up ruts and draining off the water, etc., which may accumulate on the surface from rains, may be estimated at $\frac{1}{1000}$ of the wages of a laborer, per cubic yard of earth removed for each 100 feet of lead.

Wear and Sharpening of Tools.—The expense of keeping the tools in repair and depreciation of same is about .0025 of the wages of a laborer.

Superintendence and Water Carriers.—The expense of superintendence of the work, and a boy or laborer to carry water to the men, will amount to about .015 of the wages of a laborer.

Boiler Firing.

General Manager Pilkington, of the Midland Coal and Iron Company, in an address recently delivered by him before a representative body of English iron and steel workers, touched upon the subject of boiler firing. He remarked that the application of gas to boiler firing is of very great importance. and the correct method of its application has been a somewhat neglected point; evidence of this is easily found in the many very crude appliances seen at different works. If we go to the root of the whole matter, it is evident that, to get the best duty out of the gas, it is necessary to obtain complete combustion at the highest possible temperature; and this, of course, means the highest initial temperature. Now, if we turn gas into a boiler flue, or under an egg ended boiler, with an inadequate or, or on the other hand, an excessive supply of air, and allow it to come into immediate contact under what is, comparatively speaking, a cold boiler, it may be taken for granted that that gas will never reach a high initial temperature, that there will be no complete combustion, and therefore a bad duty. In other words, it is altogether wrong to turn gas into a boiler until it has been thoroughly mixed with the requisite quantity of air, and is in a state of perfect combustion. If it is turned directly into the boiler before this has been perfectly done, and boiler chills the gas down to below the proper temperature for perfect combustion, such gas often burns in the flues and chimneys after it has left the boilers, or is, on the other hand, so effectually cooled by the boiler and excessive amount of air that all its combustion is effected at too low a temperature for effective work.

If we take the temperature of a boiler under pressure to be 300° F., and the gas in combustion at say 1,500°, both of which temperatures are well within the mark, we can readily see what will naturally take place. Again, if we take the case of the ordinary firing boilers, we find here that there is a mass of incandescent fuel on the grate, which gives a very high initial temperature to the gases. The air for the combustion of the solid fuel is supplied under the bars. while that for the combustion of the gases is supplied through the door and fire bridge, where the gases are intensely hot, aud before they have come in contact with the boiler. These several conditions are conveniently attained in gas firing by the provision of a combustion chamber, or box, in front of the boiler, the former being used when provision is made for a grate, and the latter when a grate is dispensed with. These chambers or boxes should be always well lined with good fire bricks, which prevent any dissipation of heat, and therefore become intensely hot,; and the air being admitted by proper regulators, combustion is instantaneous, and all the conditions are favorable for the attainment of a high initial temperature.

It is, of course, an axiom in modern blast furnace practice that the

whole of the power required for all the purposes connected with the furnace shall be generated by means of the furnace gases. In the case of furnaces using coal, there is an abundance, and even an excess, of gas under any possible conditions whatever. But if we take the case of furnaces using only coke, and those furnaces working on the most economical modern methods, it is seldom that there is any surplus supply of gas, and that gas is, as a rule, exceedingly poor. In such cases egg-ended boilers are inadmissible, as they are most wasteful in gas consumption, and are the most troublesome and expensive type of boilers to be met with. It is quite clear that in the future it will be necessary to employ not only the most economical type of boilers, but also the most economical type of engines, and with the very much reduced fuel consumption of modern practice, and the necessarily poorer gas, we shall be compelled to adopt the highest type of tubular boilers and compound condensing engines. Of late years, great care and attention have been bestowed upon blowing cylinders, valves and blast connections of these engines, with the result that they are now very much more effective machines than formerly. There are, even now, however, many old engines at work which, as shown by the indicator, produce only about 50 per cent. of the blast they ought to produce, owing to the bad disposition of the valve boxes and connections, which are often contracted and tortuous. Besides this, the excessive clearance at the cylinder ends, together with the clearance in the valve boxes, prevents the inlet valves from opening until the piston has traveled some part of its stroke and reduced the compressed air in these spaces to atmospheric pressure. Such engines may exist where, from the use of coal, there is an ample supply of gas, although more boilers are necessary, but with the modern coke furnaces already referred to they are not admissible.

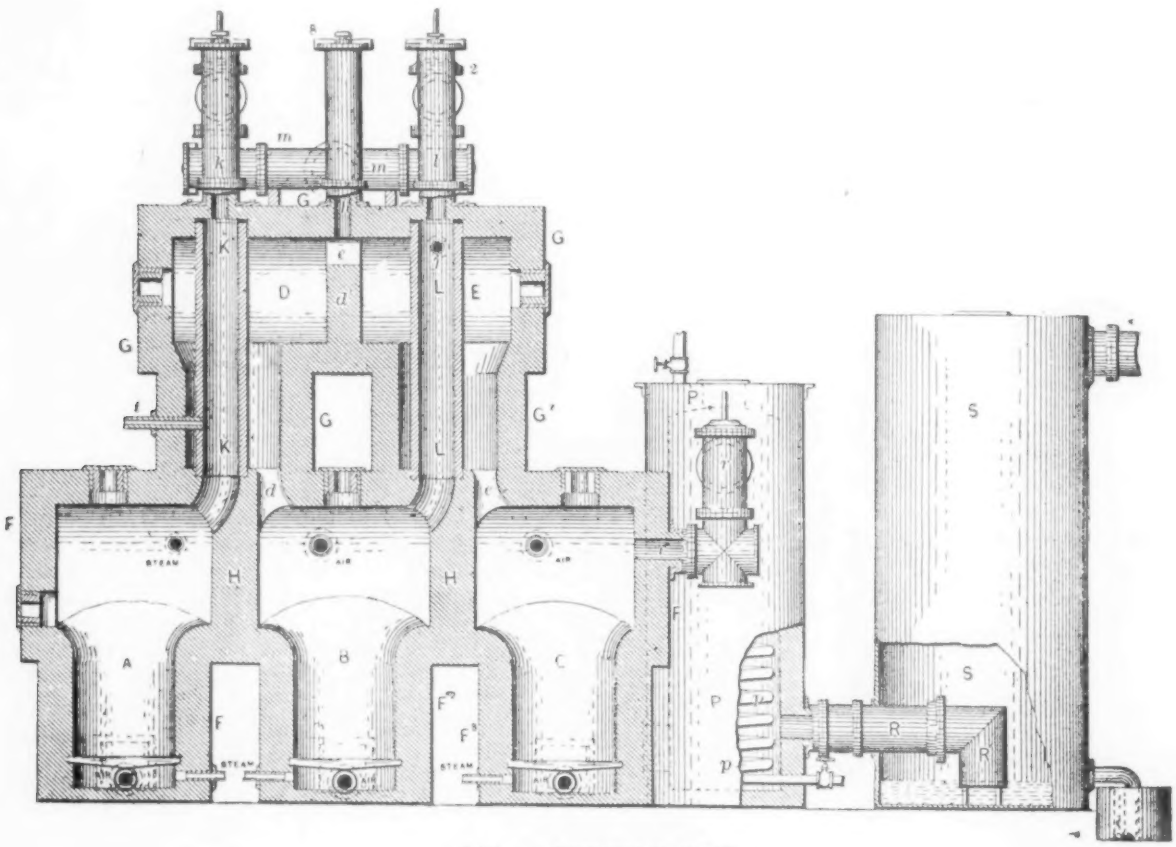


Fig. 1.—Vertical Section.

The Rose Fuel Gas Process.

Supplementing our prior mention of the fuel gas system devised by Mr. James M. Rose, we present the following description, which is taken from *Iron Age*:

We have had occasion to refer repeatedly to the efforts being made to introduce the Rose fuel gas process, which is now being introduced experimentally in one of the works of Carnegie, Phipps & Co., of Pittsburgh. The apparatus employed is shown in the accompanying engravings, reproduced from a patent granted to James M. Rose, of Allegheny, Pa., on October 13, 1891. It will be observed that it consists of two sets or sections identical in construction, each section consisting of three cupola chambers, *A*, *B*, *C*, above which there are two vertical chambers, inclosed within horizontal cylindrical casings, from which depend cylindrical legs connecting with the horizontal casing *F*, all formed of heavy plate. Each of the cupola generators, *A*, *B*, *C*, is provided with grate bars and with air and steam blast pipes at the base, while there are inlets in the upper part of the cupola, one of which, as marked in the engraving, is employed for the admission of steam while the other two are generally used for air. The vertical chambers *D* and *E* communicate with the cupola generators *B*, *C*, through ports *d* and *e*, being separated by a division wall, *d'*, but having a communicating port, *e'*, in its upper part. Through the chamber *D* passes the vertical cylinder *K*, which communicates at its base with the generator *A* and with its upper part with the pipe *k*, which is controlled by a valve opening into the side pipe *m*. A similar cylinder, *L*, communicates with the cupola generator *B*, and that, too, connects with the pipe *m*. A flue, *h*, communicates with both of the chambers, *D* and *E*, to allow for the escape of the waste product during the process of heating up the chambers. The function of the chambers *D* and *E* as accumulators of heat may be aided by filling them with checker work, loose refractory material, or with deflecting walls. At *i*, near the base of the cylinder *K*, is an inlet for the hydrocarbon, so placed that when introduced they are vaporized and carried upward by the gases. Similarly at *j*, at the cylinder *L*, is a second inlet olast at the upper end of the cylinder, because the gases descend in it. For superheating the steam used in the apparatus a superheater, *P*, is provided between the two sections, the steam passing through a system of coils, *p*. The heating in the superheater is done by the escaping gases, which subsequently pass through the scrubber *S*.

The method of operation of the plant is as follows: The producer gases formed in the cupola generators *A* of each cylinder pass upward through *K*, thus heating it, and go through the pipes *m* and *n*, through the cylinders *L* into the upper part of the producer *B*, mixing with the gas there formed and burning within the cylinder chamber *D*, to assist in the superheating in the cylinder *K*. When the proper temperature has been reached, hydrocarbons are introduced through the pipe *i*, the amount being about one-third of that required in forming the final gases. The gas so formed enters the cylinder *L*, steam being at the same time introduced into the cupola generator *A* of section 2, forming water gas. This water gas is enriched with hydrocarbon, and passing through the cross pipe *m* enters through the vertical cylinder *L*, commingling with the gases formed in generator *A* of section 1. As these commingled gases enter the cylinder *L*, an additional quantity of hydrocarbon is sprayed into it. Thus they enter the producer *B* of section 1, in which

water gas has been produced. The product rises into the vertical chamber *D*, passes through the port *e'* into the vertical chamber *E*, goes into the upper portion of the producer *C*, where again it mingles with water gas formed in this producer, both together escaping through the pipe *r* into the superheater and finally into the scrubber. When it is found necessary to reverse the apparatus on account of the cooling down of generator *A* of section 2 and of the generators *B C* and cylinders *K L* of section 1, the air blast is put into the generator *A* of section 1 and producers *B C* of section 2 being cut off, steam is fed into producer *A* of section 1 and producers *B C* of section 2, which have been highly heated by the air blast, and air is allowed to enter the producer *A* of section 2. At the same time a similar amount of air is fed into the producers *B* and *C* of section 1 and is burned in the chambers *D* and *E* of the same section to heat them up ready for subsequent reversal. The principal object aimed

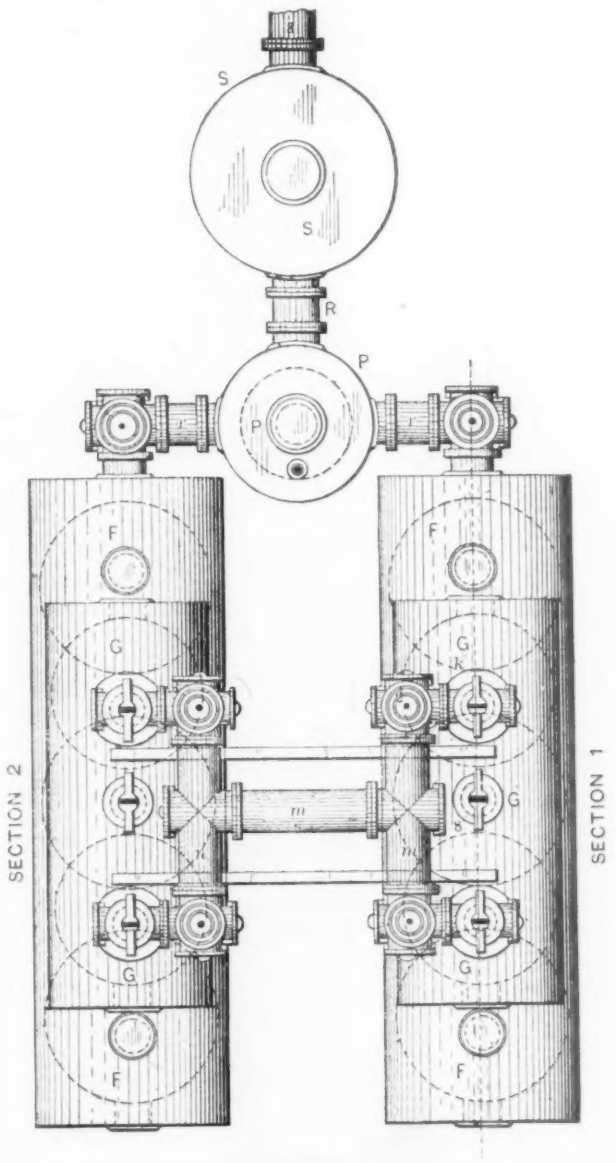


Fig. 2.—Plan.

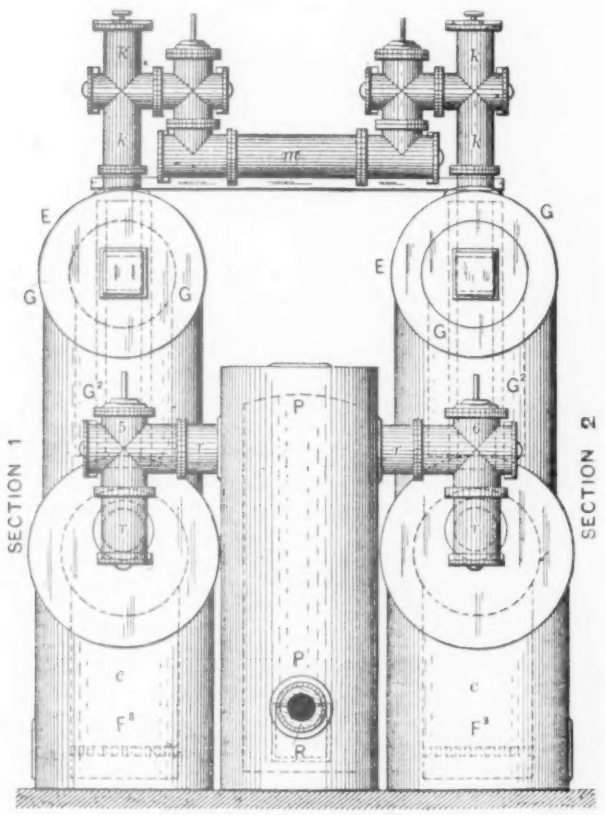


Fig. 3.—Side Elevation.

at is to thoroughly decompose the hydrocarbons by injecting them in small quantities at a number of different points, and thus to avoid the cooling down of the apparatus which would grow out of the introduction of large quantities of hydrocarbons at any one point. Mr. Rose also states that a further point aimed at is to bring the resultant gases into an atmosphere of hydrogen and carbonic acid, after the introduction of the hydrocarbon, with the object of facilitating the union of the nascent hydrogen with the hydrocarbons in the form of marsh and similar hydrocarbon gases.

ATTENTION is called to the advertisement, printed at the order of Manager Scriver, of the Montreal Gas Company, in which the Company asks for tenders for the ammoniacal liquor product of the works, for periods of one, two or three years. The competition will close on the 20th inst.

The Economic Limit of Large Power Units.

"Carleton," in the *Electrical Engineer*, says this subject has always been one of deep interest to all persons interested in electrical development, and many electrical engineers have in no way changed their views from the first, concerning the size and style of engine for electrical requirements. No well organized and regulated gas company would put all of its gas into one holder if such a thing were possible, as an accident in their works would prevent production for a short time, even if the reserve in the gasholders would continue to supply the demand. Let the gasholder be ruined or disabled for an indefinite time, then production and revenue not only cease, but business reputation suffers, a loss of confidence possesses the community and a feeling of uncertainty exists.

The vital question to be considered by electrical promoters is not what a steam horse-power costs at its station, obtained from an improved and complicated engine designed to show at its official trial a unit, for a pound, and fraction of a pound, of coal, but what does it cost to produce light commercially at the permanent location of the lamp.

Take, for example, the long-stroke, slow-speed, direct-acting, compound or triple-expansion engine, with its multiplicity of valves and intricate connections.

Floor area in places where real estate is of great value becomes the first consideration. Then multiplicity of parts increases the liability of disaster, while variation of load produces internal condensation of steam in the cylinders, caused by constantly changing temperatures, resulting in direct loss, showing a consumption of coal per horse-power per hour in the majority of direct-acting engines to be over 5 lb.

Electric railway work is proving to be the most severe problem the steam engine builder ever contended with. Rolling and sawmills were thought to be very exacting in their requirements, but now the yielding of steel and iron billets in their semi-fluid state when entering a train of rolls, as well as the entering of the circular or band saw into the log, passes out of mind when the engine builder knows and realizes that many times during the day the majority of street cars on an electrical railway start and stop simultaneously. These conditions produce a blow on the piston of the engine, which is communicated to the cross-head pin, crank-pin, main bearing, and then to the dynamo through the belt. As long stroke, slow-speed engines, with an independent cut-off for the valves, run with but little if any compression in the cylinders, there is nothing to relieve the sudden blow which occurs twice during

each revolution, and the result is quickly seen in the bearing of reciprocating parts, as well as the disintegration and unreliability of belts. The lining metal of the various boxes, which is comparatively soft, yields to the violent and sudden stress put upon it, necessitating frequent driving of keys and adjustment of quarter-boxes, accompanied by heat from excessive friction, not only resulting in loss of power, but of increasing the cause of expense and chances of disaster.

It is without doubt reliably estimated that the steam horse-powers of the world have doubled in the past seven years. This wonderful increase of power has been demanded and required by electrical development, and the shareholder now asks if a permanent and reliable investment can be offered to him, as he realizes that the days of borrowing an engine, boiler, and dynamo, together with a few lamps, placing them in some old and almost worthless building, at the same time calling the combination a "central station," is a thing of the past. It is to be regretted that numerous electrical engineers are for the sake of personal advancement constantly bringing forward, at the expense of the shareholder, new and untried experiments in special engines. The compound non-condensing engine has had quite a run, much to the disgust of the shareholder, who finds with variable load and pressure the direct acting non-condensing engine is more economical. As the electrical engineer is without financial responsibilities the burden of loss is not with him. A recent number of London *Engineering*, the leading and most reliable mechanical paper of the world, says, "Nothing is to be gained by running a non-conducting compound engine, unless it be specially designed, having constant load and pressure." In addition to this authority, it is well known that the Corliss Steam Engine Company and the Armington and Sims Engine Company, Providence, R. I., builders of long-stroke, slow-speed, and short-stroke high-speed engines respectively, refused to build non-condensing compound engines. Comment is unnecessary, unless it be to say that these well-known builders are more friendly to the electric shareholder than his electrical adviser.

The various triple-expansion engines which are now attracting considerable attention, have not yet been long enough in operation to judge of their fitness for central station work. They possess many of the objections before mentioned, and their greatest claim for superiority is based on their economical running. The measure of economy of the steam engine is determined on the consumption of steam per horse power per hour. The builder cannot always guarantee the amount of coal to be used in developing a certain amount of horse power, as more boilers evaporate 7 lb. than 9 lb. of water to a pound of coal, while some of the builders of safety water-tube boilers claim an evaporation of 10 lb. and even 11 lb. of water to a pound of coal. Recently, an official test of a triple-expansion engine was made in a well appointed central station in this country. The published result was a horse power obtained for about 12½ lb. of water. This result was certainly remarkable and unexpected, showing rapid advancement had been made. The publication of the official test showed that an allowance of a certain percentage had been made for saturation of steam by water. What this means and how the result was obtained, the report does not say, and but very few mechanical engineers claim to understand it. Without this allowance for saturation, whatever it may have been, the amount of water actually consumed was about 14 lb. per horse power per hour, and as this amount was paid for, together with the coal used to convert it into steam, the practical central station manager would base his cost of electrical production on the result of 14 lb., rather than on the theoretical 12½ lb., which in reality means nothing commercially.

If the required favorable conditions can be given to the proportioned and constructed triple-expansion engine, viz., constant pressure, load and speed, then its economical performance cannot be surpassed; but vary the conditions, as in electrical railway work, and the results must be anticipated by the practical manager, without mechanical knowledge. Many of the modern fast ocean steamships claim to produce a horse power with their triple-expansion engines for from 1½ lb. to 1¾ lb. of coal, but as a round trip of these steamers costs $75,000, and the consumption of coal is 300 tons per day, it is of course impossible to obtain reliable data, and the result given is arrived at by estimating. From the Navy Department Intelligence Series we find it is customary to estimate the amount of coal consumed on the new cruisers. How can it be otherwise, as facilities for weighing cannot be had? There, is however, the published results of one steamship trial worth repeating. The builders claimed a horse power for their engines of 1½ lb. of coal. Permission was asked by a professor of a technical college to ascertain if possible the truth of the statement. It was freely given, possibly because it was thought impossible. The ship and engines were reported to be in first class order and condition. The professor with about twenty assistants carried on their experiments, and after a continuous run of eighteen hours, actual results showed a horse power for 2¼ lb. of coal. A claim was then made that the ship and engines were not at their best, but would soon be made so, and an invitation to repeat the experiments was given and accepted. Nearly three years have passed since the first trial, yet the professor has never been asked to continue his investigations, and he never will be although he obtained and gave us reliable data commercial results. They were not wanted. In case of warm bearings, or breaking of parts of the steamships engines, it is an easy matter to slow down, and if necessary to stop for an hour or two, but not so with the triple-expansion street railway engine, with more than double the number of valve gear parts. It must not stop.

Electrical engineers from abroad say we are three years behind them in electrical development, and claim that our large unit systems of engines, with belt transmission, is also three years behind modern progress, although these large engines in some parts of the country have not yet started. Let us hope for their success, and that their comparison to the single gasholder practice may be an unfilled prophecy.

To say that the high speed, high pressure engine meets all requirements would be absurd, yet it must not be denied that this class of engine has made rapid advancement when it is known that the builders of the first successful high-speed engine in this country were compelled about ten years ago to lay aside for two years their inventions and improvements, owing to intense and not well-founded opposition. It is this class of engine that has more than contributed to doubling the horse-power of the world, at the same time compelling the builders of every known kind of engine to run it faster, improve its design and workmanship. It has compelled boiler makers to use better materials and improve their workmanship, as higher pressures are demanded. It has not only been the means of improving the standing of mechanics, materials and engineers, but it was the pioneer engine that gave commercial electricity its first start, enabling it to get a foothold.

The credit of bringing the high-speed engine into electrical prominence, although a matter of necessity, belongs to Mr. Thomas A. Edison, and an enthusiastic mechanical admirer says: "As was the inspiration of James Watt to steam, so is the knowledge of Thomas A. Edison to electricity." The *Electrical Engineer*, April 23, 1890, is quite clear on this subject, and says: "This is but a return to the original plan of Mr. Edison with his first 'Jumbo' dynamo and the Armington and Sims engine that was sent to the Paris Electrical Exhibition in July, 1881. This combination is still doing good daily service. It should some day be brought back to this country and placed in the National Museum at Washington, as it was the first successful combination ever constructed, and should be preserved." The combination should, however, first be placed in the World's Columbian Exposition, to be held in Chicago, 1893, and deserves a prominent place in the Department of Electricity among the first inventions.

Seven of the "Jumbo" combinations are still running in a central station in Milan, Italy, and although antiquated, give proof of the wisdom of the first thoughts of Mr. Edison, that should have been enlarged on by his less able and erratic followers and assistants.

Another pleasing and successful illustration is the Thomson-Houston multipolar dynamo directly connected to the double upright high-speed engine for ship lighting on the Government cruisers and merchant steamers. A large number have been built, and the combination grows in favor on its merits.

Why not continue and proceed on this line of advancement, arriving at the extreme power unit of the future for large central stations, which is to be a compound condensing engine of 500-horse power, with a speed of not less than 200 revolutions per minute, and piston speed of 600 feet or 750 feet? Stroke should be 18 inches to 20 inches, which will permit of direct acting positive valves, without complications. Armatures should be part of the engine shaft, of as great a diameter as practicable to compensate for the absence of driving pulleys or balance wheel, a most essential requisite. Simplicity reduces to a minimum the liability of disaster. Suppose a central station required 5,000-horse power, then ten 500-horse power engines should be put in, and in case one, or even two of them, or the dynamos are disabled, the remainder would have enough of reserve force to supply all demands unknown to the electrical consumer or customer or until former conditions are restored.

Two of these extreme units would not be suitable for a station of 1,000-horse powers, as a number of these combinations of various powers should be placed in each station, and if water for condensers cannot easily be obtained at small expense, then use the direct-acting engine, as about 25 times the amount of water pumped into the boilers for a certain load is required for the condensers. As the engine and dynamo duty increases, add to the present requirements another unit, and when

decreasing, take from it permanently, at the same time stopping all expense of that particular unit without destroying its efficiency as a reserve factor.

The managers of small stations should not be carried away with the one gasholder, but build wisely and well for their patrons and shareholders.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

In line with its general policy of keeping fully abreast of the times in the matter of having and using the most economical appliances, the Detroit Dry Dock Engine Company has closed a contract with the Berlin Iron Bridge Company, of East Berlin, Conn., for a new fireproof modern machine shop, which will enable the proprietors to build the largest engines with the least expense and in the shortest possible time. The building when completed will be the finest machine shop on the great lakes, and will compare favorably with any other in the country. The plant will have modern appliances, such as electric cranes two of which (of 20 tons capacity each) will run the entire length of the building. The machinery will be new, and everything is to be of the best. The shop will be 201 feet long by 66 feet in width, running along Orleans street, with end facing Guion and Atwater streets, and partly overlapping the present quarters, which are to be torn down. The main portion of the building will be 200 feet long, 37 feet wide, and 50 feet high in the clear, the aforementioned electric cranes to run the whole length, with 38 feet of clear space above the floor. Large windows will be placed along the sides, giving abundance of light, and a skylight, with 12 feet of clear glass, will run along the whole roof. Three galleries, 28 feet wide, will open out on the main shop, extending its entire length. The first two will be occupied by light machinery benches, and the top gallery is to be arranged for the storage of patterns. Work on the buildings is to be commenced forthwith, and under the contract two-thirds of the building will be erected in eight weeks and be completed in ten. The remainder will be completed as soon thereafter as the old shops can be cleared away.

A CORRESPONDENT at Chicago forwards the following: "The Jacksonville (Ills.), Gas Light and Coke Company is one of the stable institutions of that city and one which has materially contributed to the prosperity of the place. In its early days it experienced many vicissitudes, and but for the faithfulness of able, honest men it would have gone the way of many other enterprises that were only born to die. Years ago, however, it was placed on a solid financial basis, and the work of improvement has gone steadily forward, until now the Company can proudly and justly claim an unusually well equipped plant and a growing business, the manufacture of gas this year being nearly double that of '90. During its long life of over 30 years it has had but three Superintendents, J. O. King and E. J. King, father and son, both removed by death, and the present very efficient Manager, Frank M. Doan, whose energy and superior ability have done much to advance the prosperity of the enterprise. The Company has made a number of voluntary reductions in the price of gas until now it is but $2 per 1,000 cubic feet, as cheap as it can be sold by any Company in similar circumstances. The Company has nearly 30 miles of street pipes, in which there is of course great opportunity for loss by leakage and condensation. Were all the consumers compactly situated the price of gas could be very much reduced. When lighting by electricity was brought to a practical degree of perfection, the Company added that manner of producing light to its plant, and now supplies a large part of the city with this type of illumination. This winter it is expending $20,000 for two Corliss engines and other improvements. The Company is ever obliging, and although possessing a monopoly of the business, it has never taken any advantage of such a situation, but has always sought the welfare of its patrons, in the belief that that policy would be most profitable to itself. It has furnished employment for many laboring men, and is a credit to the gentlemen who constitute the Board of Directors, and Mr. M. P. Ayers, its honored President from the beginning, who is the only surviving member of the original Board."

MR. WILLIAM HUMPHREYS, who has for some years managed the works of the Dansville (N. Y.) Gas Light Company as Lessee, has been succeeded by new parties. His present address is Waterford, N. Y.

NEW purifiers have been placed in the works of the Biddeford (Me.) Gas Light Company.

WE are indebted to correspondent, at Portland, Oregon, for the following account of a suit that is now in progress at Seattle, Wash.

"The suit of the Seattle Gas, Electric Light and Motor Company against the city for $100,000 damages, alleged to have been caused to the plaintiffs property by the change in grade of Jackson street, and adjoining streets, was begun some days ago, before Judge Hume and a jury. Judge Jacobs and Messrs. Battee & Shipley represented the city, while Messrs. Blaine & De Vries and Hughes & Hastings argued for the Company. The case, which is likely to last for several days, attracts much attention, and its standing so far (up to Dec. 16) is as follows: The Seattle Gas Company, a corporation organized some years ago, by a subsequent resolution of its shareholders, sold, assigned and conveyed all of its property, except the claim set forth in this suit, to the Seattle Gas, Electric Light and Motor Company, the plaintiff in this action. In accordance with that resolution the Company executed a deed of conveyance of all of its property except this claim against the city. The city's attorneys took the preliminary position that the present plaintiff, the grantee in the deed, had no right to bring this action under the reservation both in the resolution and the deed, but that the cause of the action, if any existed at all, existed in favor of the Seattle Gas Company, the grantor in the deed. The plaintiff rejoined that notwithstanding this reservation, as it was the equitable owner of the claim it hence was the real party in interest and as such was entitled to bring this action and recover. The Court held, after a lengthy argument, that if the plaintiff could show that it was the real ower of the claim it would be entitled to show such fact, notwithstanding the fact that the Seattle Gas Company reserved the claim and the right to sue. In connection with this question, the plaintiff undertook to show that when it was incorporated it was for the purpose of becoming the successor in interest of the Seattle Gas Company, and also another corporation, known as the Seattle Gas and Electric Light Company, and that it was incorporated for the purpose of becoming such successor in interest, in accordance with the agreement between it and the other corporations. The resolutions of the Seattle Gas Company and the Seattle Gas and Electric Light Company, authorizing and directing a sale of their respective properties, were made August 26, 1890. The evidence so far put in on behalf of plaintiffs has been confined to showing that access to their property had been cut off by the high grade of the streets. Mr. Beverley, of the Tacoma Gas Company, testified that the main item of damage was, in his opinion, occasioned by reason of rendering the property inaccessible for the purpose of hauling coal, shale, etc., to and from the premises, but that if the present roadway, as now constructed on Fifth street and under Jackson street was continued that would obviate and dispense with any increased cost in getting material to and from the works. He further said that if the premises were rendered accessible from King street when the roadway of King street was constructed, this increased cost of getting in material would also be rendered unnecessary. The testimony offered by A. A. Denny on the question of damages, was that the damage to the land as such was not of great importance in respect to the mere raising of the grade, but rather because that change put plaintiff to great expense in the transportation of materials to and from the works. It is understood that defendant will attempt to prove that the city's charter gives it absolute power over the grades, and that, as the change complained of was a necessary one for the bettering of the city's highways, plaintiff must accept the conditions. The opinion prevalent, however, is that the Company will be awarded substantial damages.—W."

SUPT. C. H. DIEFFENBAUCH, of the Tyrone (Pa.) Gas and Water Company, writing under date of December 23d, says that the Kerr Murray Manufacturing Company has just completed a new holder of 20,000 cubic feet capacity for the Tyrone Company, which works most satisfactorily. Mr. D. adds, "The gas business in Tyrone is rapidly increasing, notwithstanding the electric light opposition." Good enough; and better yet—such is the general verdict.

IF those who are interested in that Harris Fuel Gas Company at Maysville, Ky., care to post themselves respecting some of the earlier movements of Mr. Harris, we suggest that they institute some inquiries in the neighborhood of Middlesboro, Ky. Perhaps Mr. W. E. Scarrett, President of the Coal and Iron Bank of that city, would say a word or two about him, and possibly E. C. Gaffield, or Dr. D. W. Butterfield, of Boston, Mass., could be induced to reveal something of their connection with the American Fuel Company, when the office of the latter was at No. 45 Milk street. The Boston folks might be communicated with by addressing them at the Langham Hotel, that city. Then there was the Union Fuel Company, of New England, and a special Fuel Company for the State of Maine. If we mistake not, Mr. Harris was then very partial to the celebrated Proctor process and patents.

WE regret to report that President Isherwood, of the Lawrenceburg (Ind.) Gas Company, is so seriously ill that his physicians have given up hope of his recovery.

MANAGER FITZ still keeps putting before the residents by pictorial method the availability of the gas distributed by the Elgin American Gas Company as a comfortable and economical substitute for solid fuel in cooking and in other domestic operations, such as ironing, heating baby's bath, and so on. His latest cartoon is a singly folded bristol board, three pages of which portray the trials and joys of a husband and wife. The trials were "on" when they used solid fuel, the joys came when bachelor Fitz showed them what gas could do.

A VERY curious case is reported from Detroit, Mich., the facts in which are these: Some time ago one Bertha Linger brought an action for damages against the Michigan Natural Gas Company, of Detroit, suing for personal injury. Complainant asserted that while driving along Vinewood avenue her horse baulked, and in his cavorting plunged into a hole in the side of the avenue. The hole was so deep that only the head and an inch or two of the animal's spine could be seen above the surface. A derrick was procured and the horse was extricated, as also was Mrs. Linger, who was not only ruffled as to her apparel and her temper, but also as to her physical system. And here the case grows crustier. Mrs. Linger testifies that the surface of the street was to all intents and purposes unbroken prior to the time that the horse baulked, but subsequent examination disclosed the fact that along the bottom of the hole in which the horse was partly buried ran a gas pipe—she knew it was a gas pipe, and so seemingly did others (her husband included), for several of them testified that they detected the odor of escaping gas—whence she and her witnesses concluded that the escaping gas destroyed the subsoil up to within an inch or more of the surface of the street, that inch or so, however, remaining firm—just as a pie crust would retain its shape after a small boy had carefully removed the "filling" of the interior. The next curiosity is the defense. The Company "defended" the case in the belief that one of its pipes did run along the bottom of the abyss that was found by Mrs. Linger's steed, and 12 good men and true decided that the gas did eat the earth away—all but the top crust—and awarded Mrs. Linger $5,000 damages. This woke the Natural Gas Company up to the fact that it might be well to definitely ascertain whether the pipe was a portion of its system or not. The examination was made, whereupon it was found that the offending circle of iron in question was a section of the city's water main—that its gas pipe was at least four feet away from the water pipe, and that the gas pipe was in good, solid ground. Armed with this knowledge, the Company's attorney at once appealed to Judge Reilly for a retrial on the basis of the discovery of "new and important evidence." When the Judge reviewed the "evidence" he ordered a retrial, but suggested that as the Company could have obtained this "additional evidence" in ample time for the first trial that it should stand the taxable costs of that trial. The question now would seem to be on the strange power seemingly possessed by the city water of cutting out the subsoil while it was unable to injure the crust. Possibly it is in the soil that the strange power exists. And, again, on the retrial, the water pipe may be shown to have been a sewer pipe; or it may be that no pipe of any description was in the cut; or—!

A SUIT that was brought at Newcastle, Ind., by the Consumers Gas Trust Company, of Indianapolis, against several farmers of Madison County, who tore up a quantity of pipe line that the Trust put under a Madison County highway in August last, was decided in favor of defendants. The claim amounted to $27,000.

THE following letter, written by Mr. William Tracy, Secretary and Superintendent of the Alton (Ills.) Gas and Electric Light Company, under date of the 23d of December, goes to show that the gas business at Alton is in prosperous condition, and also that President Underwood made no mistake when he secured that property by purchase. Mr. Tracy writes: "Not having heard from Alton in some time, it may be possible you think we are still in the old rut and not doing much; but when I tell you our business has increased 23 per cent. in the last year you no doubt will think we are still alive. I have just completed a Mitchell bench of 6 retorts and am having much satisfaction in running the same. I am also putting up a building for our electric light station; it is 45 feet by 60 feet, inside measurement. The contracts have been awarded for two 80-horse power boilers and two 80-horse power high speed engines; also, one 60 light arc dynamo and an incandescent dynamo to supply current for 650 incandescent lamps. The station is to be completed and in running order by February first. We propose supplying Upper Alton with incandescent electric light, where we have no gas mains, as well as in Alton proper. But with all this electric light we propose to still look after our gas plant, which is now in a prosperous condition. I will also be glad to welcome any gas man to my new office next spring, as I propose to alter the present electric light station to a first class office. The historic city of Alton is growing very fast and we are looking for a beautiful and populous city with well-paved streets and other improvements in progress that mark the advance of a city in population and wealth. The Gas and Electric Light Company proposes to assist the good work."

WE are called upon to announce the death, at his home in New Haven, Conn., on the evening of December 25th, of Mr. H. G. Lewis, an ex-Mayor of New Haven. His illness lasted for two weeks. Deceased was largely concerned at one time in the New Haven Gas Light Company, in fact it is said that it was largely through his efforts that the Company was incorporated. Mr. Lewis was born at Cornall, Conn., in February, 1820, and came to New Haven in 1835. In 1841 he entered the Yale Law School, graduating therefrom with the class of 1844. After he was admitted to the bar Mr. Lewis became prosecuting attorney, and, by successive stages, Clerk of the City, County, Superior and Supreme Courts. In 1853 he acquired an interest in the New Haven Wheel Company, acting as its President for several yegrs. Having represented a New Haven district in the State Assembly he was chosen Mayor of the city, and served as such from 1870 to 1876, and again in 1883–4. He was a prominent figure in the social life of New Haven, and was noted for his eloquence as an orator.

"GOOD-BYE to fuel gas schemes at Akron, Ohio; and now the shareholders in the Gas Companies there have a chance to make some money. In any event the negotiations which have been in progress there for some time have resulted in a combination of the gas interests of the city and the absorption of the old Akron Gas Light Company and the Akron Light, Heat and Power Company (fuel gas scheme) by a new incorporation known as the Akron Gas Company. The Board of Directors of the Company are: Ferdinand Schumacher, G. T. Perkins, Ernest F. Lloyd, and M. O. Hower, of Akron, and Chas. Stinchfield, G. W. Lloyd, and George Dunlap, of Detroit. The other officers are: President, G. W. Lloyd; Vice-President, F. W. Schumacher; Treasurer, George. T. Perkins; Secretary, E. F. Lloyd; Superintendent, Jas. W. Lane. It is contemplated, as soon as the necessary modification of the plant of the Company in the East End can be made, to cease the manufacture and sale of fuel water gas and to utilize the pipes of both branches of the Company for illuminating gas only. It has been generally understood that the promoters and stockholders of the Light, Heat and Power Company never made any money by the manufacture of fuel gas, as only a very great consumption of it could permit the making of a profit, considering the rates charged, and that scale of consumption would not be reached at Akron for years. Apart from this, however, the new Company finds itself confronted at the outset with a difficulty which makes the change of the product of the East End plant from fuel gas to illuminating gas a necessity. The demand for illuminating gas is steadily increasing, and the capacity of the old Akron Gas Light Company's works, both of the manufacturing and distributing plant, is taxed to the utmost to supply the city with illuminating gas. On several occasions lately it has been only just possible, using every exertion, to keep the supply from being exhausted, and then only by reducing pressure to the lowest practicable point. This alternative has, of course, given rise to complaints in all directions. Those not acquainted with the fact that the low pressure caused the rather dim light, have readily complained that the quality of the product was not what it should be. The old works are of the 8-inch type, and with every resource availed of the product for the 24 hours could not be caused to exceed 100,000 cubic feet. The fuel gas plant is of the 16 inch type, and can be worked up to a production of 300,000 cubic feet of illuminating water gas each 24 hours. The two together, therefore, can be depended on to produce 400,000 feet daily, a quantity that Akron will not need for years to come. The Company will lay several miles of new mains this season. As far as experience goes, the Company is led to believe that what the city of Akron wants and cares most about is a properly distributed and plentiful supply of illuminating gas, and the Company proposes to make the fulfillment of this desire its primary object. The change will be made, using every precaution to avoid inconvenience and annoyance to customers of the Fuel Gas Company. It also is understood that when the changes are completed a reduction in the selling rate will be ordered.—B. R."

AN explosion occurred some days ago in the condenser room of the Mutual Gas Company, South Buffalo, N. Y. The Company's loss is put at $2,000, and an adjoining saloon and bowling alley was damaged to the extent of $300. No one was injured.

THE Citizens Gas Company, of Denver, Col., has filed its incorporation papers, which show that the nominal moving spirits in it are Jas. A. Fleming, Francis Church and William G. Evans. It is capitalized in $1,000,000, and is, in our opinion, somewhat of a doubtful enterprise. The projectors say they have acquired the rights under the Rose process of gas making for the State of Colorado, and that so equipped they can make and distribute a high candle power gas in Denver, at a profit with a rate of 40 cents per 1,000 cubic feet. It is this that causes us to believe that the enterprise is a doubtful one, for they cannot do anything of the kind.

ELSEWHERE we mention a suit for damages brought by the Seattle Gas, Electric Light and Motor Company, against the city of Seattle for damages caused to the Company's premises by the action of the city in raising certain street grades. Since that mention was put in type, we received the following further particulars respecting the actual changes in the grades, the printing of which will enable our readers to more readily appreciate the way in which the Company was injured: On May 18, 1883, the City Council passed an ordinance (383) establishing the grade of Jackson street at an elevation 15 feet above datum at South Fifth street, and 20 feet above datum at South Sixth Street. By this ordinance King street was established at an elevation 10 feet above datum at South Fifth and South Sixth streets. The grade of Main street was established 25 feet above datum at South Fifth and 56 feet at South Sixth street. The contract for grading these streets was let to G. N. Alexander, on July 4, 1883, and he subsequently completed the work. Soon after the grade was established the Gas Company expended $200,000 in improving its buildings and plant, in the belief that the grades were to be permanent. On June 26, 1889, however, the Council passed another ordinance (No. 1,116) re-establishing the grade of Jackson street, raising the elevation so as to make a total fill of 29.25 feet at South Fifth street, and 20.75 feet at South Sixth street. By this change of grade, the Gas Company's plant stands so low that the roofs of the buildings are on a level with the sidewalks.

ABOUT three weeks ago Louisville, Ky., was the scene of a fierce fire that destoyed the buildings of the Boone Paper Company. The ruins of the buildings were the nesting places for smoldering fires of so pronounced a nature that one fire company remained for some time pouring water on the dangerous embers. While engaged in this task an explosion occurred that caused the weakened walls to topple and four firemen were killed thereby. At the coroner's inquest successful effort was made to show that the explosion resulted from the negligence of the Gas Company in failing to shut off the gas supply from the ruined factory—that is, the effort was successful in that the jury referred the explosion to the cause mentioned, and in their verdict severely censured the Gas Company. The facts, however, are that the Gas Company cut out the supply some hours before the explosion occurred, and any escape that took place afterward must have been occasioned by those connected with the Fire Department, who were in full charge of the premises.

THE jury in the Seattle case returned a verdict in favor of the city.

A CORRESPONDENT at Chicago, writing under date of December 29, says: "Mr. S. S. Stratton, formerly of the Goodwin Meter Company's Chicago branch, will represent Messrs. Harris Bros. & Co. in the West, beginning January first——Sorry I am to say that Mr. Charles Faben, Jr., of Toledo, Ohio, has been a victim of *la grippe*, but am glad to report that he is convalescent——Uncle Jerry Howard goes to Galena, Ills. He takes charge there to-morrow——Mr. Fred. Shelton, of the National Gas Light and Fuel Company, is in the East, during the holidays. Fred. will have the Chicago Gas Club to himself now, with Howard and Persons both away. The Club is sure to thrive, and in time every gas man in the United States will enjoy its hospitality."

THE Provo City (Utah) Council has declared forfeited the franchise for a gas works granted some time ago to Messrs. Van Horne & Le Seur.

SUPERINTENDENT S. E. GRAVES, of the Geneva (N. Y.) Gas Light Company, is very much pleased over the success of the coke breaking machine recently installed at the works.

COL. FRED. BENSON, of the Nassau Company, of Brooklyn, N. Y., is a very busy man these days.

Explosions in Manufactories of Brown Coal Briquettes.

The London *Journal* says that Messrs. Holtzwart and Meyer have recently undertaken some researches with the view of arriving at the cause of explosions in briquette factories in Germany. A disaster of this nature occured at Reichenwald, in the room where the coal, after being ground and dried, was stored. The front of the drying house was blown out, and a serious conflagration ensued. At Furstenburg, the ignition commenced in the lowest feeding screw belonging to the drying-room elevator; and it spread forward to the store-room and backward to the drying-houses. Five explosions followed in quick succession in different parts of the works—the strongest being in the store-room; and in a few minutes all the chambers containing dry coal dust were on fire. In this case the buildings were entirely of stone and iron, so that no damage followed; and no injury occurred to workmen. These two accidents support the known fact that dry coal dust is of itself a dangerous explosive.

The air from the drying ovens, some of which are heated by steam and others by direct firing, was first examined. It was found to be practically free from combustible gases; the only one present being carbonic oxide, and that in a proportion less than 1 per cent. So that no danger could possibly arise from this source. The gases evolved on heating brown coal were next tested. Dry air was passed slowly over samples of the coal heated to known temperatures, and subsequently analyzed. In this case also no appreciable amount of combustible gas was evolved. But when coal dust was heated, the result was different. At a temperature of 250° to 280° C. (480° to 530° F.), 9 grammes of coal dust yielded 349 c.c. of methane and 127 c.c. of carbonic oxide. This, however, was accompanied by 920 c.c. of carbonic acid, which would appreciably diminish any tendency to explosion. No relation could be traced between the composition of the coal and the gases obtained from it. One sample was first heated alone, and then after admixture with 2 per cent. of pyrites. The addition of the latter had no tendency to cause the evolution of combustible gases; but it increased the rapidity of the oxidation.

So far it appeared that there could be no possibility of an explosion from gases given off under ordinary conditions of working. It was therefore concluded that the explosive agent must be coal dust, a portion of which must be fired in the first place by some accidental circumstance. It is known that coal dust requires a high temperature for ignition, and fires more easily when in rapid motion than when at rest. With a view of arriving at further information on this point, a small explosion-tube, having a capacity of 50 c.c., was used, together with an arrangement by which a small quantity of coal dust (0.18 gramme was used for each experiment) could be projected into the tube by means of a smart puff of air. Out of three different samples, one showed a very small tendency to explode; another exploded at every trial; and a third, seven times out of nine trials. No relation could be traced between the compositions of the samples and their tendency to explode. Mere shaking of the tube would not produce an explosion, even with the most likely sample. The rapid motion caused by the puff of air was found to be necessary. And the addition of 10 per cent. of carbonic oxide to the air in the explosion-tube did not produce a perceptibly stronger explosion than that resulting with air alone.

From these experiments it is concluded that the coal dust was the cause of the accidents above described; and the authors recommend steam-heated rather than directly-fired ovens. Ventilation is mentioned as an evil rather than otherwise; being likely to aid the spread of conflagration when once commenced. The elevators and travelling parts of the apparatus, in which the dust is in rapid motion, are the most dangerous. The deductions to be drawn are obvious.

Correspondence

[The JOURNAL is not responsible for the opinions expressed by correspondents.]

That is the Question.

ROCKFORD GAS LIGHT AND COKE CO.,
ROCKFORD, ILLS., Dec. 28, 1891.

To the Editor AMERICAN GAS LIGHT JOURNAL:

Was not the year 1890 the year when the gas companies in the East were glad to get any kind of coal? If so, would not that account in some measure for the low yield that Mr. C. H. Nettleton got as shown in his paper on "Leakage?" Would his percentage of leakage have been higher if the yield had been greater, when the increased yield would be due to the use of a better grade of coal?

Respectfully, HENRY S. WHIPPLE

THE AMERICAN GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

EDITOR—Jos. R. Thomas, C.E.
ASST. EDITOR—T. J. Cunningham.
MANAGER—C. E. Sanderson.

PUBLISHED ON EACH MONDAY OF THE YEAR AT
No. 32 Pine Street, New York.

This is a recognized official organ of
LIGHT, HEAT, STEAM, WATER SUPPLY,
VENTILATION, SANITARY IMPROVEMENT,
AND GENERAL SCIENCE

TERMS:

SUBSCRIPTION—Three Dollars per annum, in advance. Single copies, 10 cents.

AGENTS.

NEW YORK.—AMERICAN NEWS CO., 39 and 41 Chambers Street.
Germany.—B. WESTERMANN & CO., of New York.

MONDAY, JANUARY 4, 1892.

Gas Stocks.

Quotations by Geo. W. Close, Broker and Dealer in Gas Stocks,

16 WALL ST., NEW YORK CITY.

JANUARY 4.

☞ All communications will receive particular attention.
☞ The following quotations are based on the par value of $100 per share.

	Capital.	Par.	Bid	Asked
Consolidated	$35,430,000	100	103½	104
Central	500,000	50	—	90
" Scrip	220,000	—	95	100
Equitable	4,000,000	100	122	125
" Bonds	1,000,000	—	106	108
Harlem, Bonds	170,000	—	—	—
Metropolitan, Bonds	658,000	—	110	115
Mutual	3,500,000	100	120	122
" Bonds	1,500,000	—	100	102
Municipal, Bonds	750,000		—	—
Northern		50	—	—
" Bonds	150,000	—	—	100
Standard Gas Co—				
Common Stock	5,000,000	100	36	40
Preferred	5,000,000	100	81	85
Yonkers		50	112	—
Richmond Co., S. I.	346,000	50	—	—
" Bonds	20,000	—	—	—
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	118	122
Citizens	1,200,000	20	92⅜	92¾
" S. F. Bonds	320,000	1000	—	103
Fulton Municipal	3,000,000	100	123	125
" Bonds	300,000		102	—
Peoples	1,000,000	10	72	77
" Bonds (7's)	368,000	—	100	—
" " (6's)	94,000	—	100	—
Metropolitan	870,000	100	97	100
" Bonds (5's)	70,000	—	100	—
Nassau	1,000,000	25	126	130
" Ctfs	700,000	1000	100	—
Williamsburgh	1,000,000	50	114	116
" Bonds	1,000,000	—	107	110
Out of Town Gas Companies.				
Boston United Gas Co.—				
1st Series S.F. Trust	7,000,000	1000	84	86
2d " " "	3,000,000	1000	70	74
Bay State Gas Co.—				
Stock	5,000,000	50	50½	51
Income Bonds	2,000,000	1000	98	102
Buffalo Mutual, N. Y.	750,000	100	105	110
" Bonds	200,000	1000	95	100
Citizens, Newark	1,000,000	50	155	160
" " Bonds	45,000	—	—	—
Chicago Gas Company	25,000,000	100	71½	71⅝
Chicago Gas Light & Coke Co.—				
G't'd Gold Bonds	7,650,000	1000	87½	88
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1000	—	97½
People's Gas and Coke Co., Chicago—				
1st Mortgage	2,100,000	1000	100	—
2d "	2,500,000	1000	96	—
Consumers Gas Light Co., Jersey City	2,000,000	100	12	15
Bonds	600,000	1000	70	75
Cincinnati G. & C. Co.	7,000,000	100	—	200
Consumers Toronto	1,000,000	50	169	172
Central, S. F., Cal.			90	—
Capital, Sacramento, Cal			58	
Consolidated, Balt.	11,000,000	100	43¾	44
" Bonds	6,400,000		107	107½
Citizens Gas Lt. Co., Rochester, N. Y.	500,000	—	85	110
Bonds	250,000		—	—
East River Gas Co., Long Island City	1,000,000	100	100	105
Bonds	500,000	100	100	102
Hartford, Conn	750,000	25	120	128
Jersey City	750,000	20	180	200
Louisville, Ky	2,570,000	50	125	130
Little Falls, N. Y.	50,000	100	—	100
" Bonds	25,000	—	100	103
Laclede Gas Light Co., St. Louis, Mo.—				
Common Stock	7,500,000	100	20½	20¾
Preferred "	2,500,000	100	59	61
Bonds	9,034,400	1000	81½	82
Montreal, Canada	2,000,000	100	200	208
Memphis (Tenn.) Gas	750,000	100	40	—
" Bonds	240,000	100	103	—
New Haven, Conn		25	200	—
Oakland, Cal.			34¾	35¼
Peoples, Jersey City		—	115	125
" " Bonds			—	—

Ammoniacal Liquor.

Tenders will be received by
The MONTREAL GAS COMPANY
until 20th of January next, for their entire production of
Ammoniacal Liquor
for one, two, or three years from 1st of May, 1892. Full particulars to be had on application.
J. F. SCRIVER, Mangr. & Sec.
Montreal, Can., Dec. 28th, 1891.

Coal Tar For Sale.

THE PEORIA GAS LIGHT AND COKE CO.
Is now open to receive bids for its product of
Coal Tar for the Year 1892.
The tar is from the best quality of Pittsburgh coal, and the quantity made about 2,000 barrels. Bids to be per gallon in tank cars, Peoria, Ill., the tanks to be furnished by the bidder. Bids will be opened Feb. 1, 1892.
PETER COFFEY, Supt.
Peoria, Ills., Dec. 18, 1891. 864-6

WANTED,

A Second-Hand Rotary Gas Exhauster,
With 6 or 4 inch connections. Mackenzie preferred. Address
TARRYTOWN AND IRVINGTON UNION GAS LT. CO.
865-3 Tarrytown, N. Y.

Coal Tar For Sale.

THE CITIZENS GAS CO., BUFFALO, N. Y
Offers for sale its product of
Pure Coal Tar,
about 150,000 gallons per year, for a term of one, three, or five years. Delivery in tank cars, N.Y.C. & H.R.R.R. track, Fourth street. Proposals will be received until January 20, 1892, and should be addressed to
P. P. MILLER, Sec.,
864-4 293 Court St., Buffalo, N. Y.

WANTED,

A Second-Hand 6-Horse Power "Poppet Valve" Otto Gas Engine,
in perfect running order.
FRAMINGHAM GAS, FUEL AND POWER CO.,
860-tf So. Framingham, Mass.

POSITION DESIRED

As Superintendent of Gas Works,
By a young man fully experienced in the details of manufacture and distribution: or as Superintendent of combined Gas and Electric Plant. Best of references. Address
857-tf "R. S.," care this Journal.

CHEMIST,

Of scientific education, successful record, and favorable experience in control of help, age 25, wants employment. Chemical and photometric control of gas. Analysis of bye-products, gas coal, etc. BALDWIN,
859-tf Box 2135, Boston, Mass.

WANTED,

FOUR PURIFYING BOXES,
6 or 7 feet square, with 6-inch connections. Must be in good condition. Address CADIZ GAS COMPANY,
863-4 Cadiz, O.

FOR SALE,

A Gasholder,
65 ft. diameter and 20 feet deep, with columns and girders. The holder is in a fair state of preservation, and could be taken down and erected in some small city or town.
ST. JOSEPH GAS AND MFG. CO.,
855-tf K. M. MITCHELL, Supt., St. Joseph Mo.

Coal Tar.

J. W. FORD,
153 Washington Street, Chicago, Ill.,
Is always ready to buy Coal Tar.

The Weston Standard
VOLTMETERS AND AMMETERS.

These Instruments are the most accurate, reliable, and sensitive portable instruments ever offered. A large variety of ranges, to meet the requirements of all kinds of work.
Send for Catalogue.
Weston Electrical Instrument Co.,
Office & Factory, 114-120 William St, Newark, N. J.

Utilize Your Gas Liquor.
NO EXTRA LABOR OR OPERATING EXPENSES.

Ammonia Concentrator.

Not Expensive. Write to
STROH & OSIUS, Pat'ees, or
Mich. Ammonia Works, Detroit, Mich.

Link-Belt Machinery Co.
CHICAGO, ILL.,
Will be pleased to furnish designs of
Elevating and Conveying Machinery
For the economical handling of Coal, Coke, Oxide, etc., in Gas Plants.

Parson's Steam Blower,

FOR IMPROVING BAD DRAUGHT IN BOILERS, AND FOR BURNING BREEZE OR OTHER WASTE MATERIAL.

PARSON'S TAR BURNER,

FOR UTILIZING COAL TAR AS FUEL.

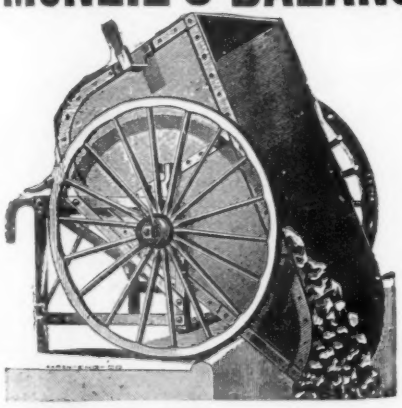
PARSON'S AIR JET TUBE CLEANER,

FOR CLEANING BOILER TUBES.

These devices are all first-class. They will be sent to any responsible party *for trial*. No sale unless satisfactory. Manufactured by the WATERTOWN STEAM BLOWER COMPANY.

H. E. PARSON, Supt., No. 54 Pine St., N. Y.

McNEIL'S BALANCED CHARGING BARROW



For Coal or Coke. Best for charging or drawing hot Coke. Dumps on the floor. Can carry 1,500 lbs. with one man power.

STEEL WHEELBARROWS.

Best Barrows Ever Made.

Send for Catalogue.

GRANT McNEIL,
225 North Union Street,
AKRON, OHIO.

CHICAGO GAS STOVE COMPANY,

240-244 W. LAKE STREET, CHICAGO.

MANUFACTURERS OF ALL KINDS OF

GAS Cooking & Heating Appliances.

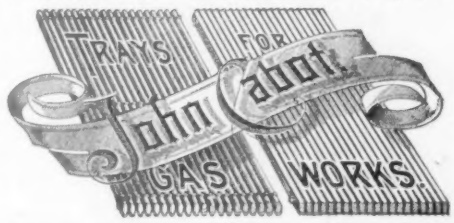
CHICAGO GAS STOVES TRADE MARK

P. C. VAN WIE, Manager.

Special Trays for Iron Sponge or Oxide of Iron.

CHURCH'S TRAYS a Specialty.

Reversible, Strongest, Most Durable, Most Easily Repaired.



306-310 Eleventh Avenue, New York.

We also make the Cheapest and Strongest REVERSIBLE BOLTED TRAYS IN THE MARKET.
Send for Circulars.

To Gas Companies.

We make to order **CAP BURNERS** to burn any amount under a stated pressure. Send for samples.

Also, SERVICE CLEANERS, DRIP PUMPS, and STREET MAIN PROVING APPARATUS.

C. A. GEFRORER,
248 N. 8th St., Phila., Pa.

MOSES G. WILDER, MECH. ENGR.

816-18-20-22 Cherry St., Phila., Pa.

Volumetric Lamp Governors

FOR GAS LAMPS & HIGH-POWER BURNERS.

Governor Burners for Street Lamps & General Use

GOVERNORS FOR ARGAND AND OTHER COMMON GAS BURNERS IN ALL SIZES.

Horizontal Governors

Specially Adapted for Gas Stoves, Furnaces, etc.

It is well known that a large majority of all High Power Gas Lamps in the United States have my Governors attached, and they are always used by the leading makers of these lamps. To remove any excuse for the use by anyone of inferior and infringing Governors, a reduction in price has been made, and all exclusive contracts are cancelled.

Correspondence Solicited with all who require a Reliable Governor.

Coal Tar Genealogical Tree

MR. T. VINER CLARKE, of London, Eng.,

Having compiled a novel Chart or Map illustrating the various

CHEMICAL PRODUCTS DERIVED FROM COAL AND COAL TAR,

In the form of a Genealogical Tree, including all the products discovered to date (the total number amounting to near 700), offers for sale a limited number of copies in Colors, mounted on Linen, with Rollers. Price, $3.50. Orders may be sent to

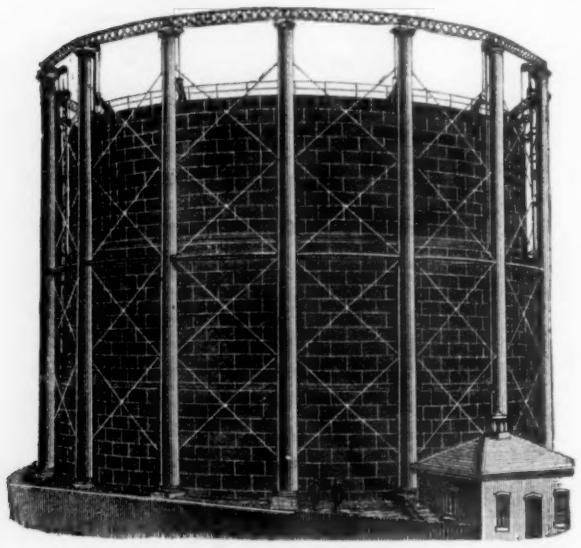
A. M. CALLENDER & CO., - - No. 32 Pine Street, New York.

The Continental Iron Works

THOS. F. ROWLAND, President. THOS. F. ROWLAND, Jr., Secretary & Treasurer. WARREN E. HILL and CHAS. H. CORBETT, Vice-Presidents.

Take East 10th or 23d St. Ferries from New York to Greenpoint.

BROOKLYN, N. Y.



BUILDERS OF

GAS HOLDERS,

SINGLE-LIFT and MULTIPLE-SECTION GAS HOLDERS A SPECIALTY.

Wrought Iron Gas Holder Tanks.

BENCH CASTINGS, RETORT LIDS,

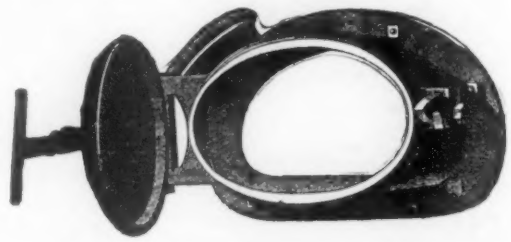
Hydraulic Mains, Condensers, Scrubbers,

PURIFIERS, VALVES, Etc.

SELF-SEALING

Retort Mouthpieces and Lids.

For Round, Oval, or "D" Retorts.



Reliable Gas Heaters,

FINEST IN THE WORLD.

HANDSOME,
POWERFUL,
PROGRESSIVE

In Construction and Artistic in Design.

Offered in all styles and sizes of Illuminators or Asbestos Flame Plates.

Gas Parlor Grates ✲ Beauties.

In Antique Bronze, Brass or Copper finish, or plain Black. Provided with Cold and Hot Air Return Flues.

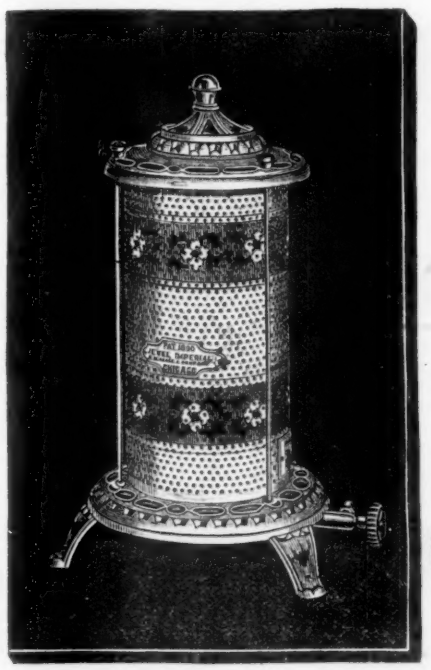
GREAT HEATERS.

Fitted for any kind of gas.

SEND FOR CATALOG.

THE SCHNEIDER & TRENKAMP CO.,

Cleveland, Ohio.



Jewel Gas Stoves

ARE THE BEST.

10 GAS HEATING STOVES,

Prices, from $4.50 to $16.50.

55 GAS COOKING STOVES,

Prices, from 75 Cents to $65.00.

Send for Catalogs and Discount.

GEORGE M. CLARK & COMPANY,

MAKERS,

157-161 Superior St., Chicago.

CHAPMAN VALVE MANUFACTURING CO.,

MANUFACTURERS OF

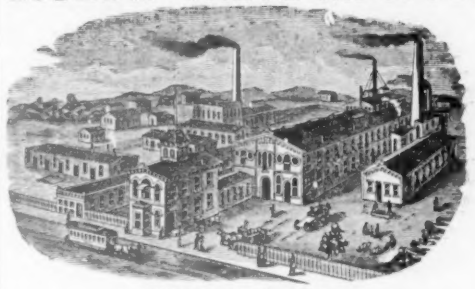
Valves and Gates for Gas, Ammonia, Water, Etc.

Also, Cate Fire Hydrants With and Without Independent Nozzle Valve. All Work Guaranteed.

WORKS & GEN'L OFFICE: Indian Orchard, Mass.

TREASURER'S OFFICE: 72 Kilby & 112 Milk Sts, Boston, Mass

LUDLOW VALVE MFG. CO.

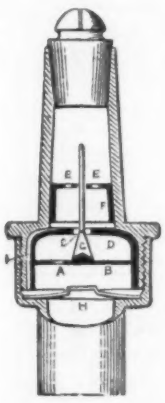


OFFICE AND WORKS,
938 to 954 River Street and 67 to 83 Vail Av.,
TROY, N. Y.

Hydraulic Main Dip Regulators, also Check Valves, Foot Valves, Yard-wash and Fire Hydrants.

Send for Circulars.

Valves.—Double and Single Gate, ½ in. to 48 in., outside and inside Screws. Indicator, etc., for Gas, Water, Steam, and Oil. Send for Circulars.



Rappleye's Rheometric Governor Burner.

Free Sample and Special Price to Gas Light Companies.

SAN ANTONIO GAS COMPANY,
SAN ANTONIO, TEXAS, May 16, 1889.

Dear Sir:—In reply to your inquiry of the 10th inst., will say that we have used your Governor Burners for our street lamps since 1884, and are well pleased with them. Yours truly,

SAN ANTONIO GAS CO.

H. W. RAPPLEYE, 2814 Poplar St., Phila., Pa.

Standard Oil Company,

GAS NAPTHA DEPARTMENT OF THE WEST.

GAS NAPTHA.

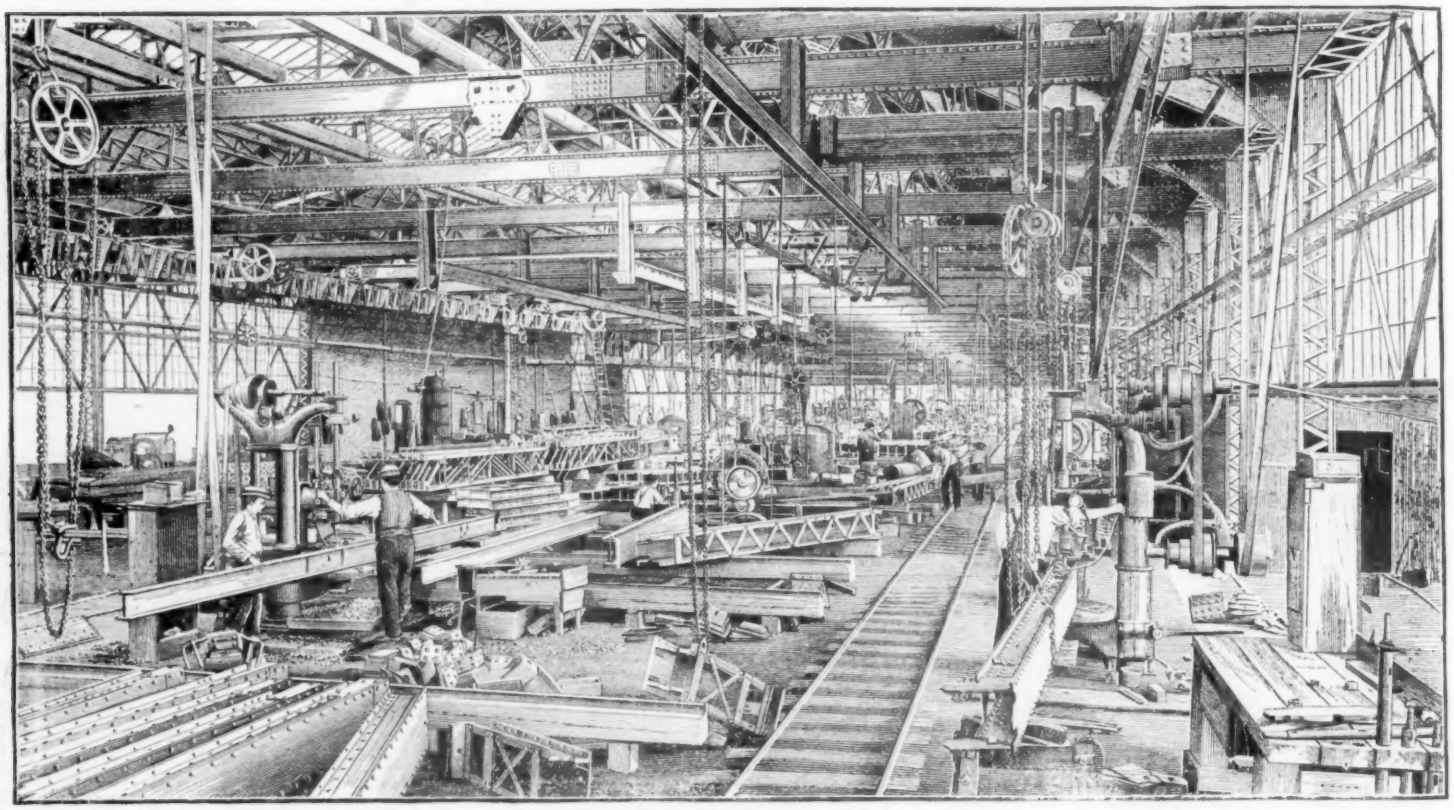
GAS OIL.

Correspondence Solicited.

CLEVELAND, OHIO.

CHAS. M. JARVIS, Prest. & Chief Engineer BURR K. FIELD, Vice-President. FRANK L. WILCOX, Treasurer. GEO. H. SAGE, Secretary.

THE BERLIN IRON BRIDGE CO.



The above illustration is taken direct from a photograph showing the interior of our truss shop. The building is 80 ft. wide by 400 ft. long, made entirely of iron and glass, no woodwork being used about the construction. This shop is fitted with all the modern appliances for turning out first-class iron bridges and iron buildings, and has a sufficient capacity to turn out 1,000 tons of ordinary work per month of thirty days. *Write for Illustrated Catalogue.*

Office and Works, No. 6 Railroad Avenue, East Berlin, Conn.

GASHOLDER PAINT.

Use Only

THE COVERNMENT WATERPROOF PAINT.

Proof against Ammonia, and Absolutely Waterproof. Send for Prices and Particulars.

THE GOVERNMENT WATERPROOF PAINT CO., 122 Milk Street, Boston, Mass.

Fuel and Its Applications

By E. J. MILLS, D.Sc. F.R.S., and F. J. ROWAN, C.E., assisted by others, including Mr. F. P. Dewey, of the Smithsonian Inst., Wash., D. C.

7 PLATES, AND 607 OTHER ILLUSTRATIONS. ROYAL OCTAVO, PAGES XX, 802. HANDSOME CLOTH, $7.50.

A. M. CALLENDER & CO., 32 Pine St., N. Y.

Water Gas! Fuel Gas!

For all Manufacturing Purposes. Generated from Bituminous Slack, Anthracite Coal Dust, or Coke Breeze, by

THE LOOMIS PROCESS.

Now in successful operation at Works of John Russell Cutlery Co., Turner's Falls, Mass., and Henry Disston's Sons' Saw Works, Tacony, Pa.

The Cheapest Gas Generating System in the World.

Utilizing any Kind of Low-Priced Coals.

NOVEL IN DESIGN, MODERN IN CONSTRUCTION, SIMPLE IN OPERATION, PERFECT IN RESULTS.

Plans and Estimates Furnished.

BURDETT LOOMIS, - - Hartford, Conn.,

Or Murray Hill Hotel. New York City.

King's Treatise on Coal Gas.

In Three Volumes. Price per Vol., $10. Sold either by Volume or in Sets.

A Standard text-book for the Engineers and Managers of Gas Works, and for all who are concerned or take an interest in the manufacture and distribution of Coal Gas, and in the utilization of the Secondary Products resulting therefrom; treating also of the Gas Engine and of Gas Cooking and Heating Appliances.

A. M. CALLENDER & CO., 32 Pine Street, N. Y. City.

GAS STOVES. GAS METERS. GAS STOVES.

THE AMERICAN METER CO.

Established 1834. Incorporated 1863.

MANUFACTURERS OF

Standard 3 Diaphragm Dry Meter.

Gas Meters,

STATION METERS,

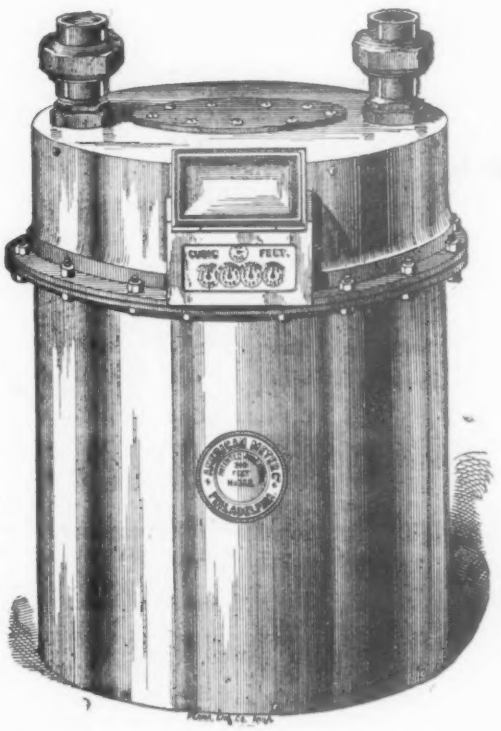
METER PROVERS, PHOTOMETERS,

Experimental Meters of all Kinds,

AND

Standard 2 Diaphragm Dry Meter.

Apparatus for Testing the Quantity and Quality of Gases.



Meters for Measuring Natural Gas.

MANUFACTORIES,

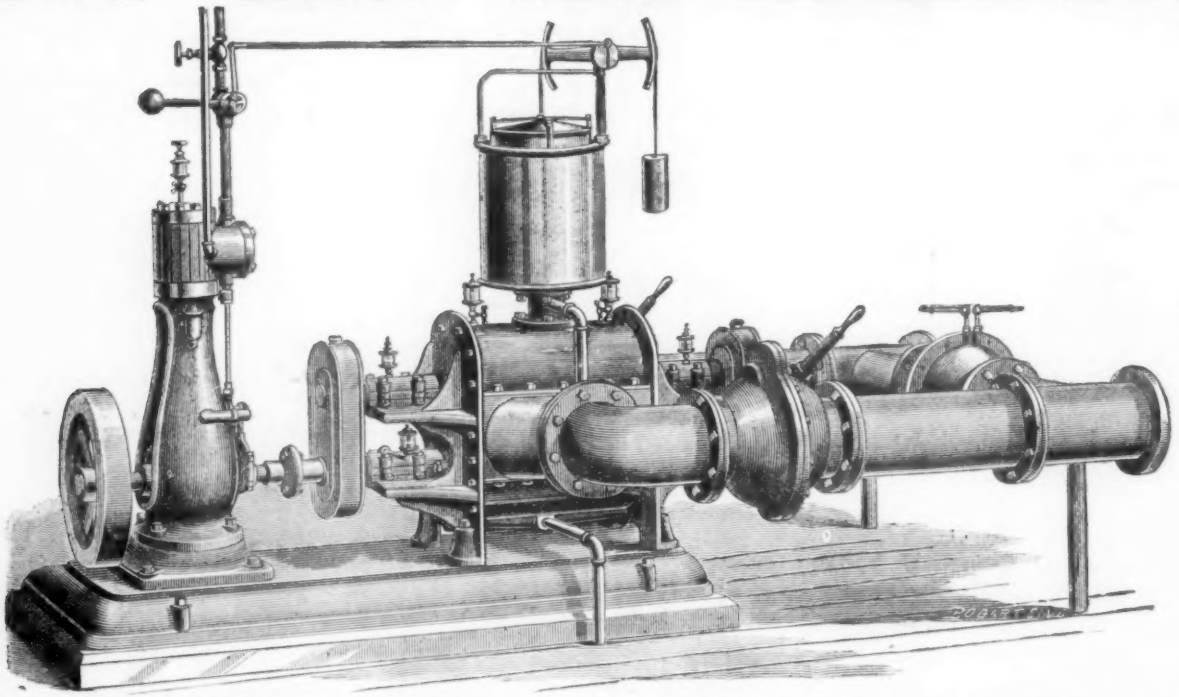
508 to 514 West Twenty-second St., N. Y. Arch and Twenty-second St., Phila.
Nos. 244 & 246 North Wells Street, Chicago, Ill.

AGENCIES,

No. 177 Elm Street, Cincinnati, Ohio. No. 222 Sutter Street, San Francisco, Cal.
No. 810 North Second Street, St. Louis, Mo.

GAS STOVE SHOW ROOMS, No. 242 Sixth Avenue, New York City.

ROOTS' NEW GAS EXHAUSTER.



We will take pleasure in furnishing estimates on complete plants, including **GAS EXHAUSTER, ENGINE, and GAS GOVERNOR,** all connected, complete, on same bedplate. Also, estimates for **GAS VALVES, BYE-PASS VALVES, and PIPE FITTINGS,** arranged in any manner to suit the exhauster room or main connections.

All flanges of pipe and valve fittings faced off, with bolt holes drilled, all ready to go together.

S. S. TOWNSEND, Gen'l Agt. / COOKE & CO., Selling Agts. } 163 & 165 Washington St., N. Y. **P. H. & F. M. ROOTS CO., Connersville, Ind.**

THE WALKER TAR AND CARBONIC ACID EXTRACTOR.

A very general demand exists, in both large and small Gas Works, for an apparatus that will be absolutely efficient in the removal of the Tar which passes the hydraulic main and condenser. Many attempts have been made to accomplish this, but, I believe, without success, until the introduction, six years ago, in England, of the C. & W. Walker Patent Tar and Carbonic Acid Extractor. During these years this apparatus has been adopted by many of the most prominent Engineers, not only in England, but also on the Continent of Europe and in other parts of the world. Several have been erected in the United States.

"The C. & W. Walker Tar and Carbonic Acid Extractor has been in operation at these works for the past six weeks, and is an unqualified success. It removes every particle of Tar from the gas in once passing through the apparatus, and a large percentage of the Carbonic Acid. I also feel quite sure that it prevents the formation and deposit of Naphthaline, because since I started the Washer I have had no stoppages from this cause. These works have been seriously troubled with Tar for many years, and I have used several kinds of apparatus and every expedient which has come to my attention for dealing with the difficulty, but without success. The Walker apparatus occupies comparatively small space, is less expensive than other systems, and requires but little attention. I carry 2½-inch seal, and have an automatic tar delivery valve. This Tar Extractor is indispensable to gas makers.

"C. A. GERDENIER, Supt. Bridgeport (Conn.) Gas Lt. Co."

This Tar Extractor will perform its work with about one-fourth the usual back-pressure heretofore required. It is simple in construction, and can be supplied at a very reasonable price—less than any other ever before introduced. Satisfactory results guaranteed in every instance.

GEO. SHEPARD PAGE, Sole Agt. for the U. S., 69 Wall Street, N. Y. City.

SCIENTIFIC BOOKS.

KING'S TREATISE ON THE MANUFACTURE OF COAL GAS. Three vols.: $10 per vol.

GAS MANUFACTURE, by WILLIAM RICHARDS. 4to., with numerous Engravings and Plates, in Cloth binding. $12.

TECHNICAL GAS ANALYSIS. $3.

GAS CONSUMER'S GUIDE. $1.

GAS MEASUREMENT AND GAS METER TESTING, by F. W. HARTLEY. $1.60

GAS CONSUMER'S HANDBOOK, by WILLIAM RICHARDS, C.E.; 18mo., Sewed. 20 cents.

A PRACTICAL TREATISE ON GAS AND VENTILATION with Special Relation to Illuminating, Heating, and Cooking by Gas, by E. E. PERKINS. $1.25.

CHEMISTRY OF ILLUMINATING GAS, by NORTON H. HUMPHRYS. $2.40.

PRACTICAL TREATISE ON HEAT, by THOMAS BOX. Second edition. $5.

STRAINS IN IRONWORK, by H. ADAMS. With plates. $1.75.

GAS WORKS—THEIR ARRANGEMENT, CONSTRUCTION, PLANT, AND MACHINERY. $8.

COAL; ITS HISTORY AND USE, by PROF. THORPE. $3.50.

THE GAS WORKS OF LONDON, by COLBURN. 60 cents.

HEAT A MODE OF MOTION, by JOHN TYNDALL. $2.50.

MUNICIPAL LIGHTING, by F. H. WHIPPLE. $1.

GAS WORKS, AND MANUFACTURING COAL GAS, HUGHES. $2.20.

THE MANAGEMENT OF SMALL GAS WORKS, by C. J. R. HUMPHRYS. $1.

MANUAL FOR GAS ENGINEERING STUDENTS, by D. LEE, 40 cents.

THEORY OF HEAT, by J. CLERK-MAXWELL. $1.25.

THE DOMESTIC USES OF COAL GAS, AS APPLIED TO LIGHTING, by W. SUGG. $1.40.

DIGEST OF GAS LAW. $5.

DISTLLATION OF COAL TAR AND AMMONIACAL LIQUOR by GEO. LUNGE. New Edition. $12.50.

A TREATISE ON THE COMPARATIVE COMMERCIAL VALUES OF GAS COALS AND CANNELS, by D. A. GRAHAM 8vo., Cloth. $3.

GAS COMPANIES DIRECTORY, 1891. $5.

THE AMERICAN GAS ENGINEER AND SUPERINTENDENT'S HANDBOOK, by WM. MOONEY. $3.

GAS ENGINE INDICATOR DIAGRAM, by W. E. AYRTON. Paper. 20 cents.

ILLUMINATING AND HEATING GA , by W. BURNS. $1.50.

TESTING PIPES AND PIPE JOINTS, by M. M. PATERSON. 80 cents.

DESIGNING WROUGHT AND CAST IRON WORK, by H. ADAMS. Paper. Three parts, 60 cents each.

NOTES IN MECHANICAL ENGINEERING, by H. ADAMS. $1.

The above will be forwarded by express, upon receipt of price. If sent by mail, postage must be added to above prices. We take especial pains in securing and forwarding any other Works that may be desired, upon receipt of order. All remittances should be made by check, draft, or post office money order.

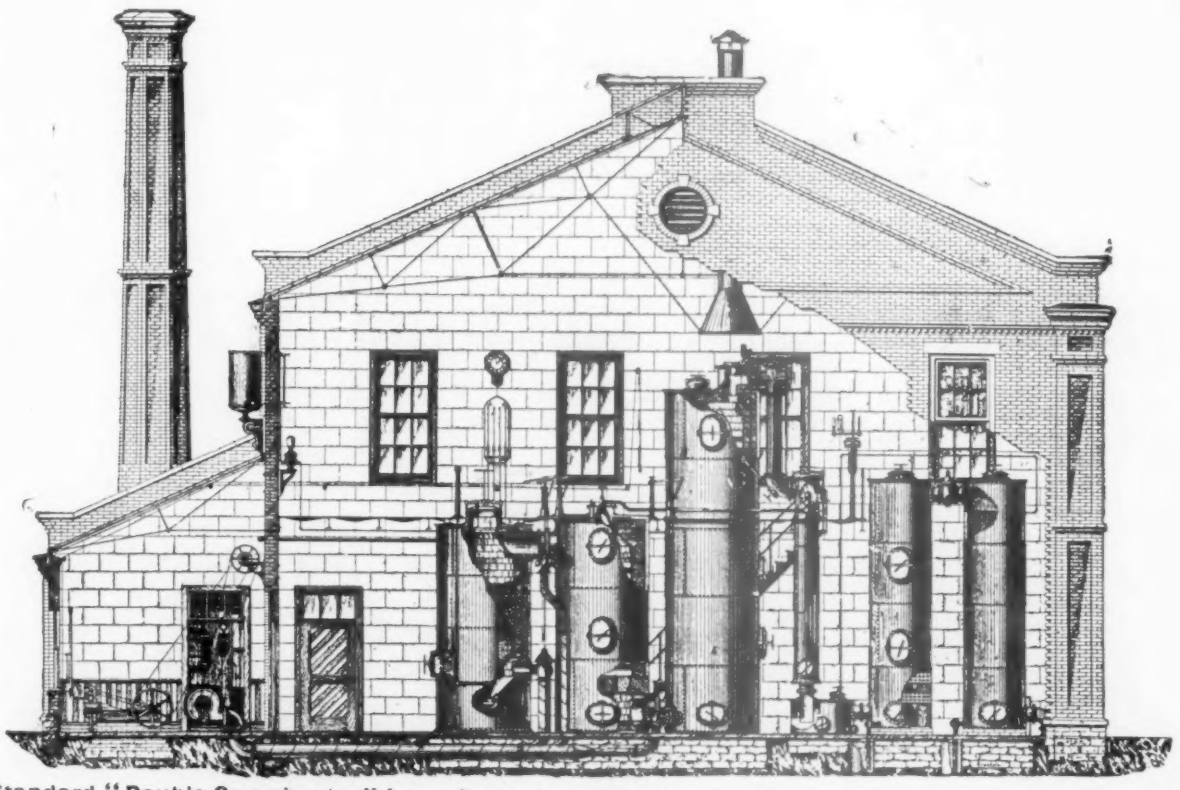
A. M. CALLENDER & CO., 32 Pine Street, New York.

THE UNITED GAS IMPROVEMENT CO.,

DREXEL BUILDING, PHILA., PA.

Owners of the Lowe, Granger-Collins, McKay-Critchlow (for carbureting Natural Gas), and Other Gas Patents.

BUILDERS, LESSEES and PURCHASERS OF GAS WORKS.



Standard "Double Superheater" Lowe Apparatus, Especially Designed for the Use of Lima Crude Oil.

Erectors of

WATER GAS PLANTS,

(Either Independent or Auxiliary to Coal Gas Works),

USING LIMA OR OTHER LOW GRADE OILS AND ANTHRACITE COAL OR GAS HOUSE OR OVEN COKE

PAMPHLETS, PLANS, AND ESTIMATES FURNISHED UPON APPLICATION.

NATIONAL
GAS LIGHT AND FUEL CO.,

No. 52 Lake Street, Chicago.

FRED'K H. SHELTON, Manager.

GAS WORKS

Built, Remodeled, Leased, or Purchased.

THE SPRINCER CUPOLA SYSTEM.

Also, by Special Arrangement with the United Gas Improvement Company,

AGENTS FOR THE WEST

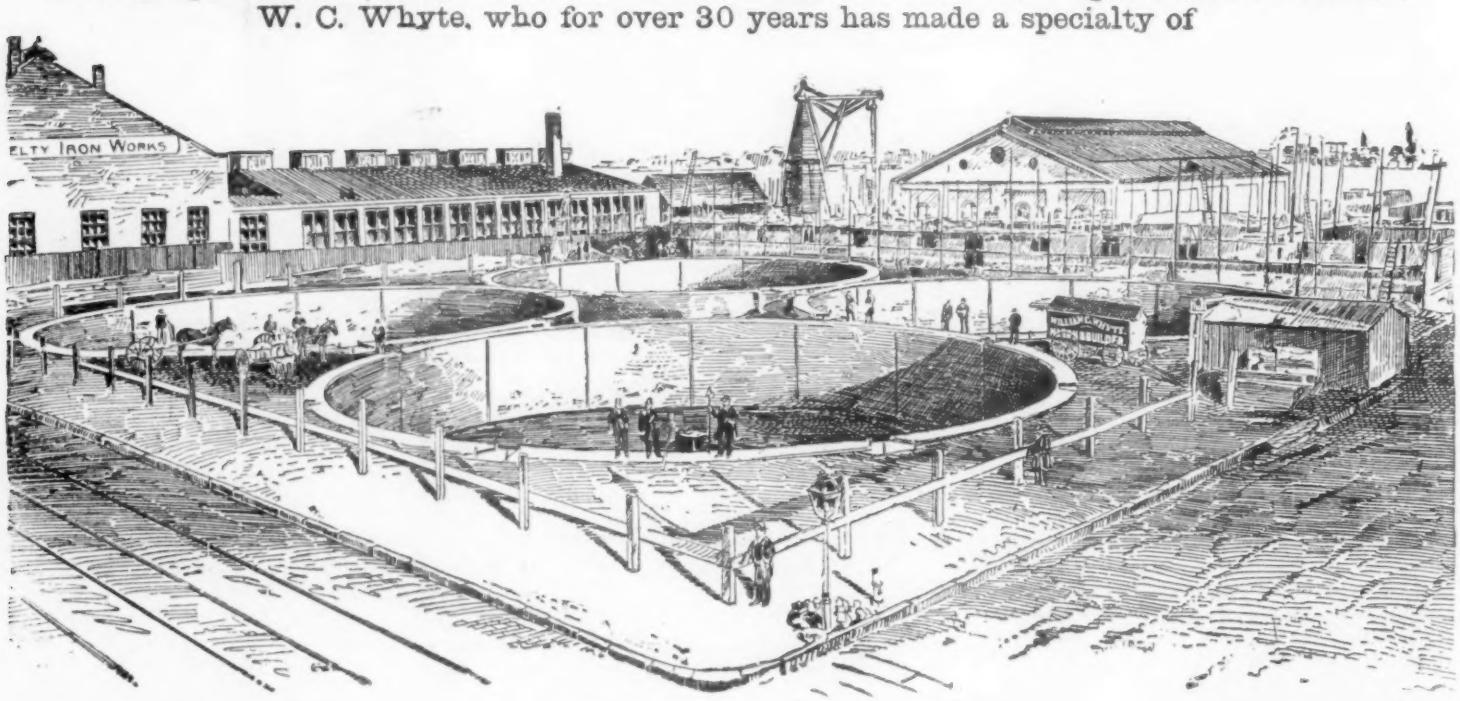
FOR THE "DOUBLE-SUPERHEATER," "JUNIOR," AND OTHER FORMS OF THE

Lowe Water Gas Apparatus.

Full Information Furnished upon Application.

GASHOLDER TANK CONSTRUCTION, ETC.

Gas Companies and others about to erect Gasholders will find it profitable to consult W. C. Whyte, who for over 30 years has made a specialty of



Tank Excavation and Mason Work.

Fifty Tanks now in operation show the sort of work done. Address

W. C. WHYTE, - No. 15 Cortlandt Street, N. Y. City.

WHAT OUR CUSTOMERS SAY OF IRON SPONGE.

COLUMBUS, O. I regard the Connelly Iron Sponge as the best form of oxide of iron of which I have any knowledge.
E. McMillin, Eng'r.

OHIO PENITENTIARY, I take pleasure in saying that the Iron Sponge bought of you two years ago, and which has been in constant use ever since, has given entire satisfaction. It does all you claim for it; in fact it reduces the cost of purifying to almost nothing—which certainly ought to be satisfactory. R. P. Green, Supt.

CINCINNATI, O. Our experience shows that by the use of Iron Sponge in place of lime we have effected a saving of 1.4 cents per M. in cost of purification. A. Hickenlooper, Prest.

SANDUSKY, O. The Iron Sponge has been a great advantage and saving to us over old method. Thos Wood, Supt.

CADIZ, O. We have been using your Sponge for five years with entire satisfaction, and at about one-fourth the cost when we used lime for purification. A. N. Hammond, Supt.

LOGAN O. We have no desire to go back to purification by lime.
A. Michie, Sec.

LIMA, O. We have used your Iron Sponge for two years, nothing else, and are entirely satisfied with it. Lima Gas Lt. Co.

TROY, O. Recommend Iron Sponge to any Gas Company. It is as good and far cheaper than lime, and far less labor connected with it. R. A. Dittmar, Supt.

WOOSTER, O. We have used your Iron Sponge about 8 months with entire satisfaction, and we shall continue to use it as long as we can do so with the success we have had thus far.
Wooster Gas Lt. Co.

HAMILTON, O. We have been using your Iron Sponge for the past 5 years exclusively—using no lime with it—and it affords us pleasure to testify to its merits. Our present lot has been in use now over 16 months. D. H. Hensley, Sec.

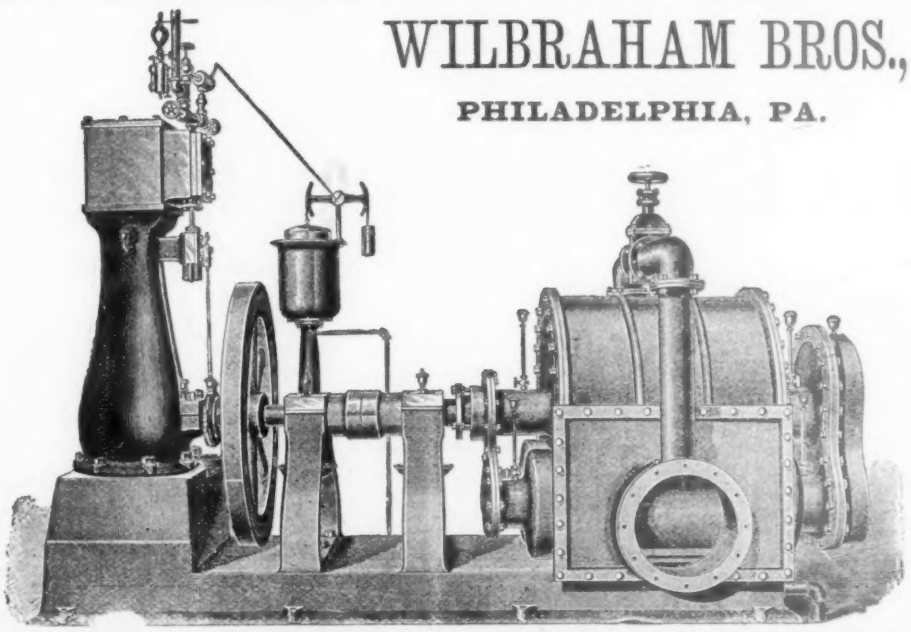
MANSFIELD, O. Our Company has been using your Iron Sponge for 2 years in our works for purifying. It has been very satisfactory, and we would not know how to get along without its use.
G. S. Harris, Supt.

PORTSMOUTH, O. We have been using your Iron Sponge, and so far *it has given entire satisfaction.* J. W. Smith, Sec.

PAINESVILLE, O. We have used your Iron Sponge for the past 2 years, and shall continue to use it. *It gives perfect satisfaction.* J. W Alexander, Prest.

CONNELLY IRON SPONGE AND GOVERNOR CO., No. 111 Broadway, New York.

WILBRAHAM
GAS EXHAUSTER & ENGINE COMBINED.



WILBRAHAM BROS.,
PHILADELPHIA, PA.

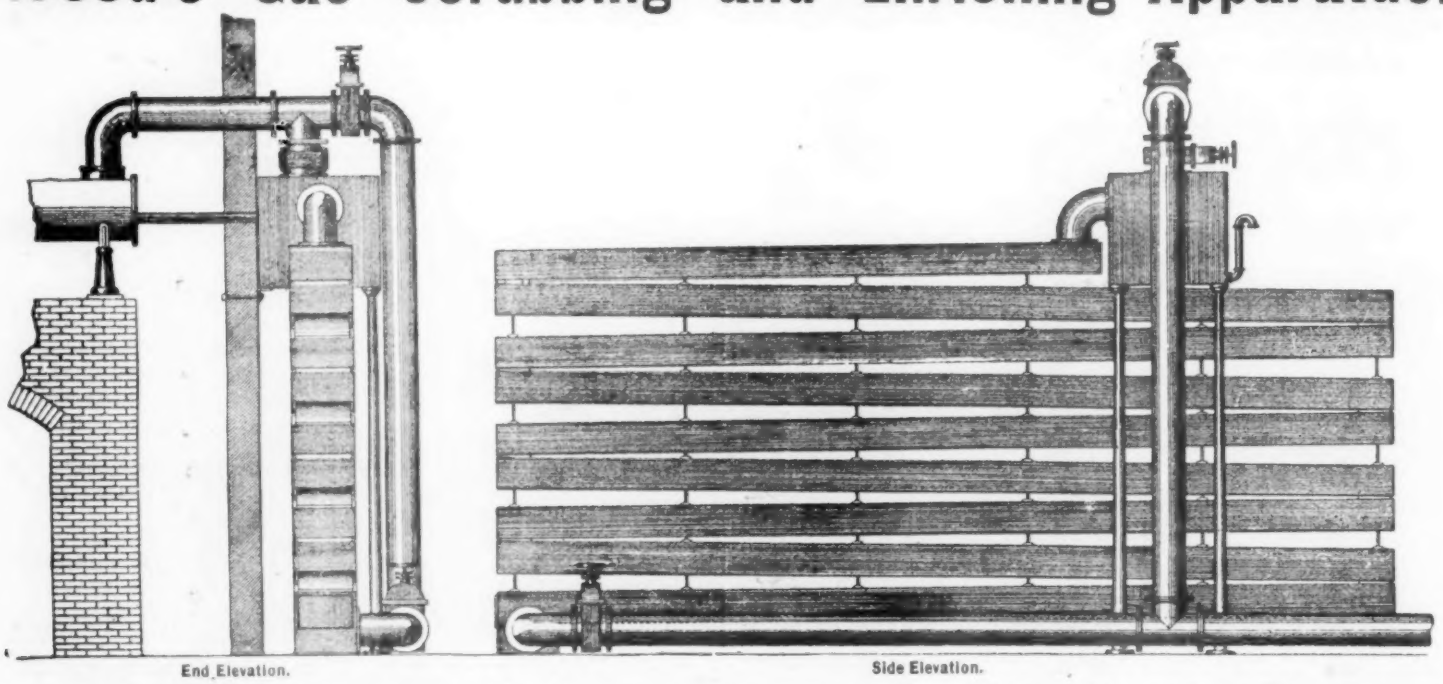
IRON MASS
For Gas Purification.
Acts immediately, and more efficiently than any other purifying agent now in use.
Greenpoint Chemical Works.
JOHN SCHRIEVER, Manager.
Greenpoint Ave. & Newtown Creek, Brooklyn N.Y.

JARVIS ENGINEERING CO.,
61 Oliver St., Boston, Mass.
CONTRACTORS FOR ERECTING
COMPLETE STEAM OUTFITS FOR ELECTRIC LIGHTING STATIONS.
Steel Boilers set with Jarvis Pat. Boiler Setting
To burn COKE SCREENINGS for Fuel.
ARMINGTON & SIMS CO. ENGINES,
Belting direct to Dynamos, without using Shafting.
SEND FOR CIRCULARS.
References.—Charlestown Gas & Electric Light Co., Charlestown, Mass.; Schenectady Gas & Electric Light Co., Schenectady N. Y.; Brookline Gas Co., Brookline, Mass.

Gasholder Tanks & Gas Works Masonry Complete.
PLANS PREPARED AND ESTIMATES FURNISHED AT SHORT NOTICE.
J. P. WHITTIER, 70 Rush St., near Division Av., Brooklyn, N. Y.
A Large Quantity of Ground Fire Brick For Sale Cheap.

1891 DIRECTORY 1891
OF AMERICAN GAS COMPANIES.
Price, - - - - - - - $5.00.
A. M. CALLENDER & CO., No. 32 Pine Street, New York City.

Wood's Gas Scrubbing and Enriching Apparatus.



End Elevation. Side Elevation.

The cheapest, simplest, and most effective apparatus for removing Tar and Ammonia, and enriching Gas, ever brought to the attention of Gas Manufacturers. With ordinary condensers and scrubbers the condensable illuminants flow off to the tar wells and liquor tanks and are lost, but with Wood's Apparatus these illuminants are saved and retained in the gas, thus increasing its illuminating power and making a great saving in the cost of enriching material. Where set up next after the Hydraulic main, this Scrubber produces an 8-oz. Ammoniacal Liquor.

JAMES R. FLOYD & SONS, - - Nos. 531 to 543 West 20th Street, N. Y. City.

FORT WAYNE ELECTRIC CO.

FORT WAYNE, IND.

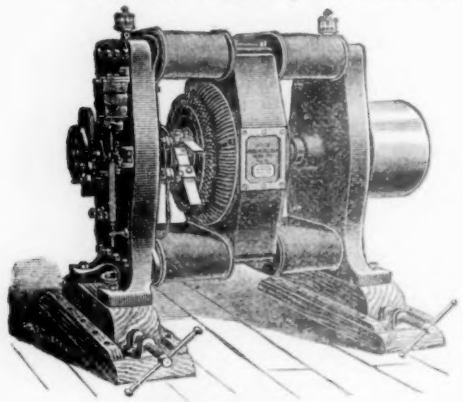
MANUFACTURERS OF THE

Slattery Induction System

—OF—

LONG DISTANCE INCANDESCENT LIGHTING.

The Most Carefully Worked Out and Complete Alternating Current System of Electric Lighting in Existence.



Wood Dynamo.

—AND THE—

WOOD

Automatically Regulating

ARC DYNAMOS AND LAMPS.

Main Office and Factory, Fort Wayne, Ind.

BRANCH OFFICES.

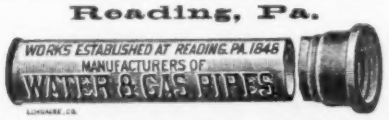
NEW YORK, - - - 115 Broadway,
PHILADELPHIA, - - 907 Filbert Street,
CHICAGO, - - - 185 Dearborn Street,
SAN FRANCISCO, - 35 New Montgomery Street,
BUFFALO, N. Y., - 328 Pearl Street,
PITTSBURGH, PA., - - 533 Wood Street.
DALLAS, TEXAS, - - - McLeod Building.
TORONTO, CANADA, - 138 King Street, West.
MEXICO, F. Adams' Successors, - City of Mexico.
CUBA, Maloas & CO., - - Havana.

ENGINEERS. GAS AND WATER PIPES. GAS AND WATER PIPES.

P. D. WANNER, Chairman. A. H. MELLERT, Mangr. of Wks.
R. B. KINSEY, Secretary. F. A. KNOPF, Treasurer.

MELLERT FOUNDRY & MACHINE CO. Ltd. and READING FOUNDRY CO., Ltd.

Reading, Pa.



Specials—Flange Pipe, Valves and Hydrants Lamp Posts, Retorts, etc.

General Foundry and Machine Work.
JOHN FOX, Selling Agent. **160 Broadway, N.Y.**

THE OHIO PIPE COMPANY,

MANUFACTURERS OF

Cast Iron Gas & Water Pipe,

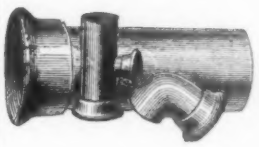
BRANCH AND SPECIAL CASTINGS.

Gas-House Bench Castings, Hydraulics, Lamp Posts, Flange Pipe and Specials, Architectural Castings, Building Columns, Joists, Cellar Grates, Sash Weights, etc.

GENERAL FOUNDERS AND MACHINISTS.

Columbus, Ohio.

WARREN FOUNDRY AND MACHINE CO.,



Established 1856. Works at Phillipsburgh, N. J.

New York Office, 160 Broadway.

CAST IRON WATER AND GAS PIPE,

FROM THREE TO FORTY-EIGHT INCHES DIAMETER. ALSO, ALL SIZES OF

Flange Pipe for Sugar House and Mine Work. Branches, Bends, Retorts, etc., etc.

M. J. DRUMMOND,

SPECIAL CASTINGS AND LAMP POSTS.

Office, Corbin Building, 192 Broadway, N. Y.

EMAUS PIPE FOUNDRY.

DONALDSON IRON COMPANY. **EMAUS, PA.**

MANUFACTURERS OF

CAST IRON PIPE AND SPECIAL CASTINGS

FOR WATER AND GAS.

THE ADDYSTON PIPE AND STEEL COMPANY.

CAST IRON **CINCINNATI, OHIO.**

PIPE

FOR MANUFACTURED AND NATURAL GAS AND WATER.

SPECIALS, FLANGE PIPE, AND LAMP POSTS

JOS. R. THOMAS,

No. 32 Pine Street, N.Y. City.

CONSULTING AND CONSTRUCTING

Gas Engineer and Contractor.

PLANS, SPECIFICATIONS, AND ESTIMATES FURNISHED.

Contracts taken for all Appliances required at a Gas Works,

Either for New Works or Extensions to Old Plants.

JAMES R. SMEDBERG,

Gas Engineer,

213 Jefferson Ave., Peoria, Ill.,

Will furnish Plans, Specifications and Estimates for the Remodeling or extension of Gas Works. Also, Analytic Reports upon the business condition and prospects of Gas Companies. Ample references will be given.

DURAND WOODMAN, Ph.D.,

Analytic and Technical

CHEMIST.

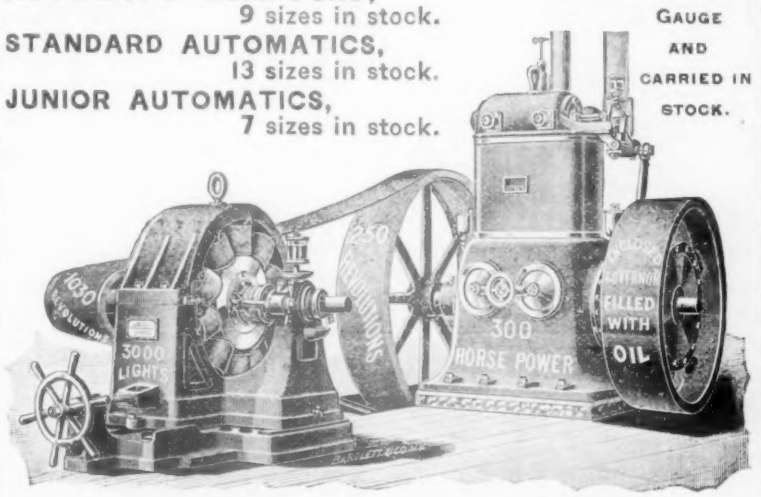
Analyses of Gas, Fuel and Gas Coals, Crude and Refined Petroleum, Materials for Gas Purification, Tar, Ammoniacal Liquors and other Bye-Products, Fire Clays, Deposits in Mains, Water for Steam Making, Boiler Scale, etc., etc. Expert work in connection with "Damages to adjacent water supplies and adjoining properties." Experimental Investigations for Inventors.

127 Pearl Street (Hanover Square), N. Y.

WESTINGHOUSE ENGINES

AUTOMATIC COMPOUND,
9 sizes in stock.
STANDARD AUTOMATICS,
13 sizes in stock.
JUNIOR AUTOMATICS,
7 sizes in stock.

REPAIRS MADE TO GAUGE AND CARRIED IN STOCK.



COMPOUND DRIVING DYNAMO.

THE WESTINGHOUSE MACHINE COMPANY.
PITTSBURGH. PENNA. U.S. OF A.

RETORTS AND FIRE BRICK.

J. H. GAUTIER & COMPANY

CORNER OF

GREENE AND ESSEX STREETS,

JERSEY CITY, N. J.

MANUFACTURERS OF

Clay Gas Retorts,

Gas House Tiles,

Fire Bricks, Etc. Etc.

Ground Clay, Fire Brick and Fire Sand in Barrels,

H. GAUTIER, Prest. CHAS. E. GAUTIER, Sec. & Treas.
CHAS. E. GREGORY, V.-Prest. DAVID R. DALY Gen'l Mang'r.

BROOKLYN

Clay Retort & Fire Brick Works,

(EDWARD D. WHITE & CO.)

Manufacturers of Clay Retorts, Fire Brick, Gas House and other Tile.

VAN DYKE, ELIZABETH, RICHARDS & PARTITION STS.

Office, 88 Van Dyke St., Brooklyn, N. Y.

RETORTS AND FIRE BRICK.

LACLEDE FIRE BRICK MFG. CO.,

MANUFACTURERS OF

Fire Brick, Gas Retorts,

AND

ST. LOUIS STANDARD SEWER PIPE.

Blast Furnace and Cupola Linings, every description of Fire Clay Material, Fire Clay Flue Linings, Chimney Tops Dry Milled and Crude Fire Clays, etc.

OFFICE AND DEPOT

901, 903, and 905 Pine Street,

ST. LOUIS, MO.

ESTABLISHED IN 1845.

B. KREISCHER & SONS,

OFFICE FOOT OF HOUSTON ST., E.R., N.Y.

Gas Retorts,

TILES, FIRE BRICK.

AND EVERYTHING IN THE FIRE CLAY LINE.

RETORTS AND FIRE BRICK.

MANHATTAN

FIRE BRICK & ENAMELLED CLAY

RETORT WORKS

ADAM WEBER.

CLAY GAS RETORTS AND RETORT SETTINGS

FIRE BRICKS, TILES, ETC.,

Office and Works, 15th Street and Avenue C., N. Y

Works, LOCKPORT STATION, PA.

—ESTABLISHED 1864.—

JAMES GARDNER, JR.,

Successor to WILLIAM GARDNER & SON.

Office, Rooms 19 & 20, Lewis Block PITTSBURGH, PA, P. O. Box 373

Fire Clay Goods for Gas Works.

SOLE REPRESENTATIVE OF THE McILHENNY REGENERATIVE BENCHES FOR THE U. S.

H. A. NORTON, No. 92 WATER STREET, BOSTON, MASS., Agent for the New England States.

HENRY MAURER & SON,

(ESTABLISHED 1856.)

EXCELSIOR FIRE BRICK & CLAY

RETORT WORKS

WORKS, Perth Amboy, N. J.

OFFICE, 418 to 422 East 23d St., N. Y.

Clay Gas Retorts,

BENCH SETTINGS,

Fire Brick, Tiles, Etc.

GEROULD'S IMPROVED RETORT CEMENT.

A Cement of great value for patching retorts, putting on mouth-pieces making up all bench-work joints, lining blast furnaces and cupolas. This cement is mixed ready for use. Economic and thorough in its work. Fully warranted to stick.

PRICE LIST.

In Casks, 600 to 800 lbs., f.o.b. N. Y., at 5 cents per pound.
In Kegs, 100 to 300 lbs., " " at 6 " "
In Kegs less than 100 lbs., " " at 7 " "

C. L. GEROULD & CO.,

5 & 7 Skillman St., Brooklyn, N. Y.

Western Agt., H. T. GEROULD, Jeffersonville, Ind.

Parker-Russell Mining and Mfg. Co.,

CITY OFFICE,

Mermod-Jaccard Bldg., Rooms 307 & 308, Broadway & Locust St., St. Louis. Mo.

PROPRIETORS OF THE

OAKHILL GAS RETORT & FIRE BRICK W'KS

Our immense establishment is now employed almost entirely in the manufacture of

Materials for Gas Companies

We have studied and perfected three important points. Our retorts are made to stand changes of temperature, the strongest heats of the furnace, and the abrasion of feeding and emptying. We have the *exclusive Agency for the West* of the celebrated

Kloenne-Bredel Full Depth and Semi-Recuperator Benches,

And also furnish and build

Our Own Styles Semi-Recuperator Furnaces for the use of Coal or Coke as fuel.

THOS. SMITH, Prest. AUGUST LAMBLA, Vice-Prest. & Supt.

BALTIMORE

RETORT & FIRE BRICK CO.

MANUFACTORY AT

LOCUST POINT BALTIMORE, MD.

Clay Retorts, Blocks & Tiles

FIRE BRICK, FIRE CLAY,

AND FIRE CEMENT.

Red and Buff Ornamental Tiles and Chimney Tops. Drain and Sewer Pipe (from 2 to 30 inches). Baker Oven Tiles 12x12x2 and 10x10x2.

WALDO BROS., 88 WATER ST., BOSTON, MASS

Sole Agents the New England States.

Boston Fire Brick Works Manufacturers of **Gas Retorts and Settings**

Under the Personal Supervision of MR. GEO. C. HICKS late of Chicago.

Fire Clay Goods of all kinds. Akron Sewer Pipe, Lime, Cement, etc. Agts. for the Arc Gas Lamp & Governing Gas Burners.

Send for Circulars and Prices to

FISKE, COLEMAN & CO., Managers, No. 62 Congress Street, Boston, Mass

FRED. BREDEL, C. E.,

PROP'R OF KLOENNE AND BREDEL PATENTS.

Recuperative Furnaces, Purifying Machines,

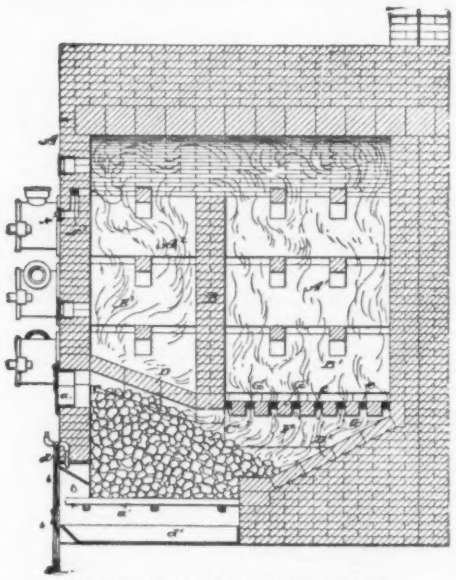
* Gas Apparatus. *

Main Office, 118 Farwell Avenue, Milwaukee, Wis.

New York Office, 22 Beaver Street.

FLEMMING'S

Generator-Gas Furnace



Materials furnished and Benches erected by

J. H. GAUTIER & CO., - Jersey City, N. J.

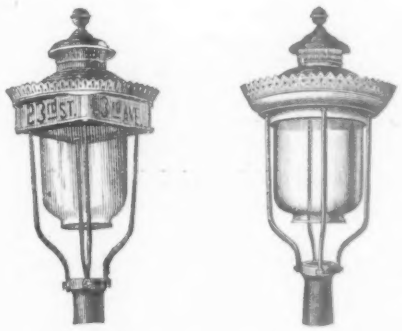
Address as above, or D. D. FLEMMING, Jersey City, N. J.

AMERICAN GAS LIGHT JOURNAL

$3.00 per Annum.

A. M. CALLENDER & CO.,

32 Pine Street, N. Y.



The Miner Street Lamps.

Jacob G. Miner,

No. 823 Eagle Ave., New York, N. Y.

Bartlett Street Lamp Mfg. Co.

MANUFACTURERS OF

Globe Lamps,

FOR

Streets, Parks, Public Buildings, Railroad Stations, etc.

LAMP POSTS

A Specialty.

Office and Salesroom,

40 & 42 COLLEGE PLACE, - - N. Y. CITY.

Gas Companies and others intending to erect Lamps and Posts will do well to communicate with us.

The American Gas Engineer and Superintendent's Handbook.

By WM. MOONEY.

350 Pages, Full Gilt Morocco. Price, $3.00.

A. M. CALLLENDER & CO., 32 Pine St., N. Y.

DAVIS & FARNUM MFG. CO.,

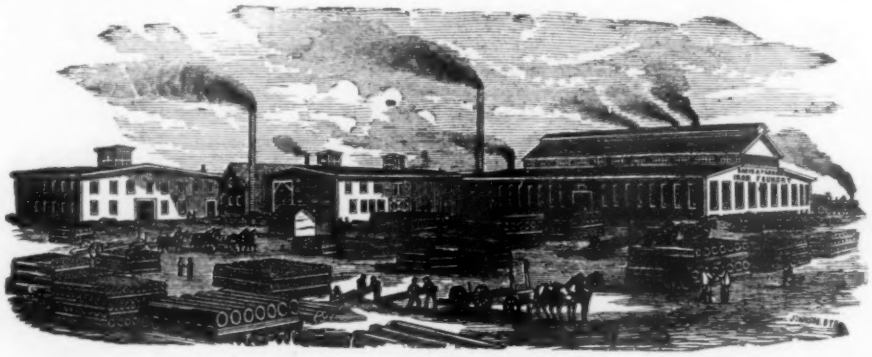
WALTHAM, MASS.

PRINCIPAL OFFICE AND WORKS, Waltham, Mass. BOSTON OFFICE, Room 18, Vulcan Building, 8 Oliver Street.

SINGLE, DOUBLE, AND TRIPLE LIFT

Gasholders.

OF ANY CAPACITY.



TUBULAR, PIPE, AND SINUOUS FRICTION

Condensers.

OF ALL SIZES.

IRON ROOF FRAMES AND FLOORS.

Purifying Boxes, Center Seal or Valve Connections, Bench Work.

Reversible Lime Trays.

SELF-SEALING AND PRESSED STEEL MOUTHPIECE LIDS.

Coke Barrows, Coal Wagons, and all Apparatus Requisite for a Complete Gas Plant.

— ALSO —

Gas and Water Pipe, Flanged Pipe,

Sugar House Work, and Special Castings of all Descriptions.

Established 1861. **Incorporated 1881.**

KERR MURRAY MFG. CO.,

FORT WAYNE, IND.

Those who are in need of

Holders or Gas Works Apparatus of any Description,

AND OF THE LATEST IMPROVEMENTS,

will find it to their interest to

GET AN ESTIMATE FROM US

before placing their order.

As we make a Specialty of this Class of Work, and are Practical Builders and Manufacturers of same,

with our long years of experience in the business,

WE CAN GUARANTEE YOU SATISFACTION.

Estimates, Plans and Specifications Furnished on Application.

BARTLETT, HAYWARD & CO.

Baltimore, Md.

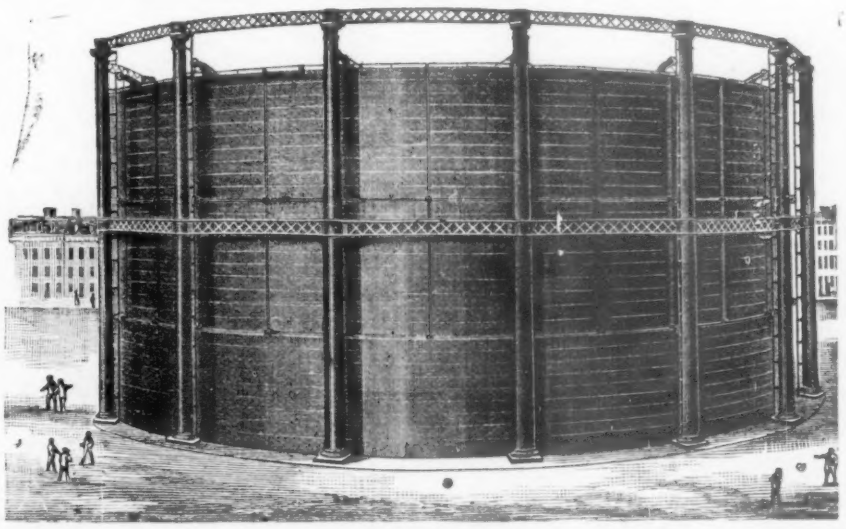
Triple Double, & Single-Lift
GASHOLDERS.

Iron Holder Tanks.

ROOF FRAMES.

Girders.

BEAMS.



PURIFIERS.

CONDENSERS.

Scrubbers.

BENCH CASTINGS.

OIL STORAGE TANKS.

Boilers.

The Wilkinson Water Gas Process.

THIRTY-CANDLE, NON-CONDENSABLE, FIXED GAS. THE MOST SUCCESSFUL GAS PROCESS IN OPERATION.

Munich Regenerative Furnace, System Drs. Schilling & Bunte.

MILL'S REVERSIBLE LIME TRAYS.

Gas Works Designed and Constructed.

Pascal Iron Works. ESTABLISHED —1821.— Delaware Iron Works.

MORRIS, TASKER & CO.,

INCORPORATED.

OFFICE, 224 SOUTH THIRD STREET, - - PHILADELPHIA, PA.

CONTRACTORS, BUILDERS, AND MANUFACTURERS OF

Gas, Water & Sugar Works

Bench Castings.

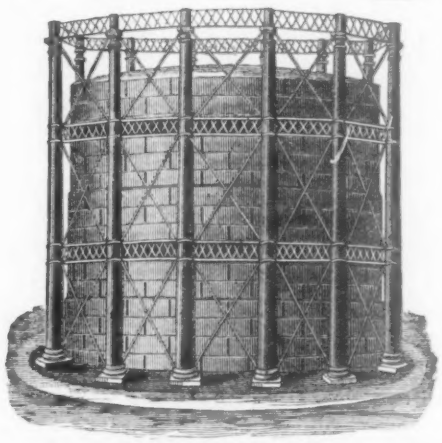
Condensers.

Scrubbers.

Purifiers.

Hyd. Carriages.

Iron Floors,



Iron Roofs.

Street Stops,

Valves, etc.

Stand-Pipes.

Water & Oil

Tanks, all Sizes.

Single, Double, and Triple-Lift Gas Holders.

SELF-SEALING RETORT LIDS. STAMPED STEEL RETORT LIDS.

Locomotive Water Columns, Filters, etc. Boiler Tubes, Wrought Iron Pipe & Fittings.

Plans, Specifications and Estimates for all kinds of Machinery furnished on application.

Foundries & Works, MILLVILLE, FLORENCE, and CAMDEN, N. J.

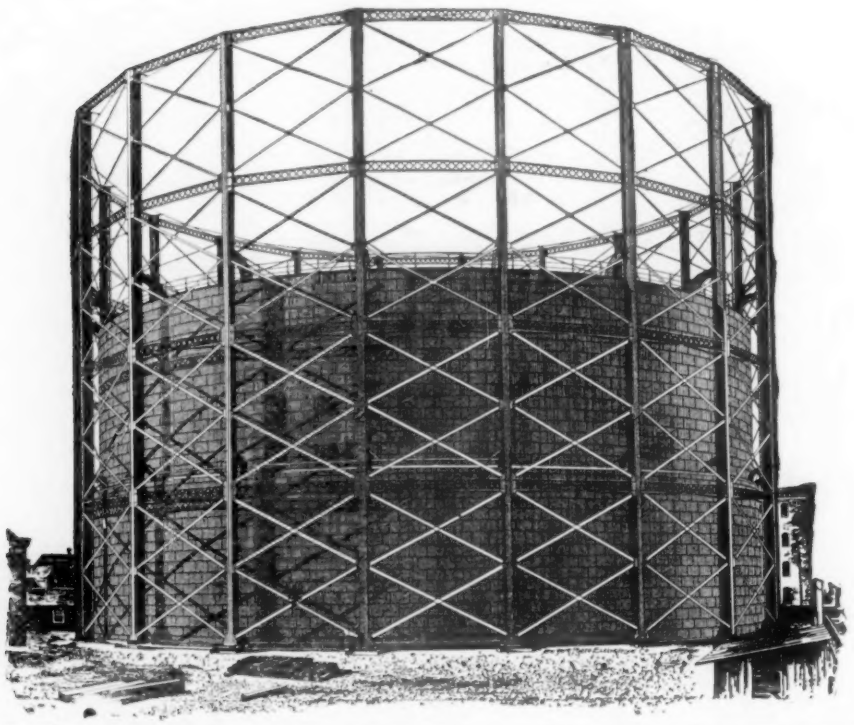
R. D. WOOD & CO.,

Engineers, Iron Founders, and Machinists.

400 Chestnut St. PHILADELPHIA, PA.

MANUFACTURERS OF

CAST IRON PIPE,



Gas Holders,

SINGLE, DOUBLE, AND TRIPLE LIFTS, WITH OR WITHOUT WROUGHT IRON OR STEEL TANKS.

PURIFIERS, CONDENSERS.

Scrubbers.

BENCH WORK.

Iron Floors and Roofs, Plate Girders.

Heavy Loam Castings.

HYDRAULIC WORK.

Lamp Posts, Valves, Etc.

ISBELL-PORTER COMPANY,

G. G. PORTER, Prest. (Successors to SMITH & SAYRE MFG. COMPANY) CHAS. W. ISBELL, Secy.

ENGINEERS AND CONTRACTORS FOR THE

Construction and Extension of Gas Works.

Special Castings, Tees, Bends, etc.
Bench Castings.
Water Gas Generators.
Hydraulic Mains.
Iron Floors.
Brenner Self-Sealing Retort Lids.
Tar Gates and Hydraulic Main Dip Regulators.
Hutchison's Tar Displacement Apparatus.
Multitubular Condensers.
Standard Washer-Scrubbers.
Tower Scrubbers.
Walker's Tar and Carbonic Acid Extractors.
Exhausters.
Engines.
Steam Jet Exhausters.
Exhauster Governors.
Compensators.
Self-Acting Bye-Pass Valves.
Valves.
Valve Stands with Indicators.
Purifying Boxes.
Purifier Valve System.
Center Seals.
Street Governors.

Estimates, Drawings and Specifications Furnished for the Alteration, Improvement, or Extension of Existing Works or the Construction of New Works.

ISBELL-PORTER COMPANY,

No. 245 Broadway, New York City.

GAS WORKS APPARATUS AND CONSTRUCTION. GAS WORKS APPARATUS AND CONSTRUCTION.

JAMES R. FLOYD & SONS,

(SUCCESSORS TO HERRING & FLOYD)

Oregon Iron Works,

W. 20th & 21st. Sts., bet. 10th & 11th Avs.,

NEW YORK CITY.

Engineers and Contractors

FOR THE

CONSTRUCTION OF GAS WORKS.

MANUFACTURERS OF

All Kinds of Castings and General Ironwork

FOR

GAS APPARATUS.

Bench Castings, Regenerative and Half Regenerative Furnace Castings.

Condensers, Scrubbers, Purifiers, Street Drips and Connections,

Valves,

Hydraulic Hoisting Purifier Carriage, Self-Sealing Retort Lids, Improved Valve Stand and Indicator, Seller's Cement.

Plans, Specifications, and Estimates furnished for Construction of New or Alteration of Old Works.

Bouton Foundry Co.,

FOUNDERS AND MACHINISTS,

CHICAGO, ILL.

Gas Works Apparatus,

PURIFIERS, CONDENSERS,

Bench Work

SPECIALS. LAMP POSTS,

SCRUBBERS,

Iron Roofs and Floors.

Plans and Estimates furnished for new works or extensions of old works.

H. RANSHAW, Prest. & Mangr. WM. STACEY, Vice-Prest. T. H. BIRCH, Asst. Mangr. R. J. TARVIN, Sec. & Treas.

STACEY MFG. CO.,

MANUFACTURERS OF

Single and Telescopic Gasholders,

IRON ROOFS, BRIDGES, LAMP POSTS,

Water and Oil Tanks, Coal Elevator Cars,

COKE CRUSHERS, BENCH CASTINGS,

And all kinds of Wrought and Cast Iron Work used in the erection of Coal and Oil Gas Works. Rolling Mill Machinery and Heavy Castings a Specialty.

Foundry: 33, 35, 37 & 39 Mill Street.

Wrought Iron Works: 16, 18, 20, 22, 24 & 26 Ramsey Street.

Cincinnati, Ohio.

1842. # DEILY & FOWLER, 1891

Laurel Iron Works.

Address, No. 39 Laurel Street, Philadelphia, Pa.

BUILDERS OF

GASHOLDERS,

Single and Telescopic.

Holders Built 1885 to 1890, Inclusive

Omaha, Neb.	Port Chester, N. Y.	Paducah, Ky.	Tacony, Pa. (two)	Central Gas Lt. Co., New York City (2d)
Scranton, Pa. (2d)	New Rochelle, N. Y.	Norwich, Conn.	Mount Vernon, N. Y.	Tacoma, Wash.
Long Island City, N. Y.	Salem, N. J. (3d)	Seattle, W. T.	Binghamton, N. Y.	Knoxville, Tenn.
Macon, Ga.	Omaha, Neb. (2d)	San Diego, Cal.	Concord, N. H.	Pottstown, Pa.
York, Pa.	Lynn, Mass. (2d)	Northern Gas Lt. Co., of New York, N. Y.	Dover, Del. (2d)	Victoria, B. C.
Chester, Pa.	Little Rock, Ark.	Westerly, R. I.	Calais, Me.	Vancouver, B. C.
Hazleton, Pa. (2d.)	Irvington, N. Y.	Willimantic, Conn	New London, Conn. (2d)	Charlottesville, Va.
Staten Island, N. Y.	South Boston, Mass.	Montclair, N. J.	West Chester, N. Y.	So. Framingham, Mass.
Saugerties, N. Y.	Rye, N. Y. (2)	Attleboro, Mass.	Bay Shore, L. I.	Woonsocket, R. I.
Clinton, Mass. (Lan. Mills)	Woodstock, Ont.	Santa Cruz, Cal.	Washington, D. C.	Simcoe, Can.
Chattanooga, Tenn.	Malden, Mass.	Erie, Pa. (2d)	Newport, R. I. (2d)	Pittsfield, Mass. (2d)
Galveston, Texas. (3d.)	Staten Island, N. Y. (2d)	West Chester, Pa. (2d	Morristown, N. J.	Chattanooga, Tenn. (2d)
Fort Plain, N. Y.	Woodstock, Ont.	Lancaster, Pa. (3d	Lebanon, Pa.	
Brunswick, Ga.	Malden, Mass.		Oakland, Cal.	

PATENTS.

FRANKLIN H. HOUGH

Solicitor of American & Foreign Patents.

925 F. ST., WASHINGTON, D. C.

(NEAR U.S. PATENT OFFICE.)

Personal attention given to the preparation and prosecution of applications for Letters Patent. All business before the U. S. Patent Office attended to for moderate fees. **No Agency in the United States possesses superior facilities for obtaining Patents,** or for ascertaining the patentability of inventions. Copies of patents furnished for 25 cents each. Correspondence solicited.

GREENOUGH'S

"DIGEST OF GAS LAW."

Price, $5.00.

This is a valuable and important work, a copy of which should be in the possession of every gas company in the country, whether large or small. As a book of reference it will be found invaluable. It is the only work of the kind which has ever been published in this country, and is most complete. Handsomely bound. Orders may be sent to

A. M. CALLENDER & CO., 32 Pine St., N. Y.

WM. HENRY WHITE,

No. 32 Pine Street, - - - New York City.

ENGINEER AND CONTRACTOR FOR THE

ERECTION AND EXTENSION OF

GAS, WATER, AND ELECTRIC LIGHT WORKS.

Correspondence with Gas Companies contemplating extending or improving their Plants respectfully invited.

Plans and Estimates Furnished

GAS COALS. CANNEL COALS. GAS ENRICHERS.

JAMES D. PERKINS. **PERKINS & CO.,** F. SEAVERNS.

228 & 229 Produce Exchange, New York.

Cable Address, "PERKINS, NEW YORK." Post Office Box 3695, New York.

GENERAL SALES AGENTS FOR

The Youghiogheny River Coal Company's

OCEAN MINE YOUGHIOGHENY GAS COAL.

HON. W. L. SCOTT, Prest. M. H. TAYLOR, Vice-Prest.

This Colliery is located at SCOTT HAVEN, PA., in the center of the Youghiogheny Gas Coal District, and produces the ONLY RELIABLE YOUGHIOGHENY COAL for gas purposes. (See Map on p. 87 of this JOURNAL, Feb. 16, '85.)

POINTS OF SHIPMENT,

Locust Point, BALTIMORE. Pier No. 62, PHILADELPHIA.

ST. GEORGE, STATEN ISLAND, N. Y. HARBOR.

Also, Shippers of the following well-known Cannels:

Breckenridge & Old Kentucky Boghead from Kentucky,

AND THE

JELLICO CANNEL, from TENNESSEE.

Within the past four years we have delivered these Cannels to over One Hundred and Fifty Gas Companies in Thirty-five different States, and to some of the largest Gas Companies in

GREAT BRITAIN, ON THE CONTINENT, AND SOUTH AMERICA.

Single carloads or more delivered at any required point in the United States and Canada. Cargo shipments from

NEW YORK, PHILADELPHIA, BALTIMORE, NORFOLK, AND NEWPORT NEWS.

Particulars as to prices, etc., furnished upon application to the above address.

JAMES & WILLIAM WOOD,

Gas and Cannel Coal Contractors,

No. 40 St. Enoch Sq., Glasgow. No. 2 Talbot Court, London.

Proprietors of the **BATHVILLE COLLIERIES** (which produce the celebrated **BOGHEAD CANNEL**), Shields, Shieldmuir, Drumpeller, and other Collieries. This Firm offer

STANDARD CANNELS,

Unequaled as Gas Enrichers.

Analyses, prices, and all further information furnished on application to

Agency for U. S., Room 70, Nos. 2 & 4 Stone St., N.Y. City.

Established 1860.

CAESAR BROS.,

MANUFACTURERS OF

ENAMELED

Gas, Water Meter, and Clock

DIALS.

ALSO,

Enameled Iron Plates in Colors, and the Patent Enameled Letters and Numbers.

We make a specialty of this class of work, and, with our long experience of over 30 years, can guarantee not only satisfaction and correctness, but extremely low quotations. ESTIMATES AND SAMPLES FURNISHED ON APPLICATION.

Office & Salesrooms, 11 Park Row, N.Y.

Factory, 153, 155 157, 159 West Avenue, Hunters Point L. I., N. Y.

COKE CRUSHERS. GAS COALS. GAS COALS.

The Despard Gas Coal Co.,

MINERS AND SHIPPERS OF

DESPARD GAS COAL,

AND MANUFACTURERS OF

COKE.

MINES, Clarksburg, Harrison Co., W. Va.
WHARVES, Locust Point, Baltimore, Md.
OFFICE, 44 South Street, Baltimore, Md

ROUSSEL & HICKS, 71 Broadway, N. Y. } AGENTS. } BANGS & HORTON, 60 Congress St., Boston.

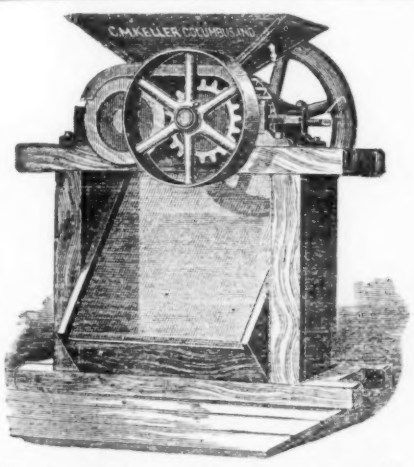
COXE BROS. & CO.

Cross Creek, Sugar Loaf & Beaver Meadow Lehigh Coals.

General Office, 143 Liberty St., New York.

Boston, 70 Kilby Street; Phila., 420 Walnut Street; Chicago, "The Rookery"; Buffalo, Coal and Iron Exchange; Milwaukee, 91 Michigan Street.

E. B. ELY, Gen'l Agent.



Keller's Adjustable Coke Crusher.

SIMPLE, STRONG, AND DURABLE.

C. M. Keller, Sec. & Supt. Gas Lt. & Coke Co. Columbus, Ind.

Correspondence Solicited.

Electric Light Primer.

BY CHARLES L. LEVEY.

A simple and comprehensive Digest of all the most important facts connected with the running of the Dynamo and Electric Lights, with Precautions for Safety, etc.

Price, 50 cents.

A. M. CALLENDER & CO., 32 Pine St., N.Y.

THE PENN GAS COAL CO.

OFFER THEIR

Coal, Carefully Screened & Prepared for Gas Purposes

Their Property is located in the Youghiogheny Coal Basin, near Irwin and Penn Stations on the Pennsylvania Railroad, and on the Youghiogheny River.

Principal Office:

209 SOUTH THIRD STREET, PHILA., PA.

Points of Shipment:

Pennsylvania Railroad Piers; Greenwich Wharves, Delaware River: Pier No. 1 (Lower Side), South Amboy, N. J.

Chesapeake & Ohio Railway Coal Agency,

FOR THE SALE OF THE

Superior Kanawha Gas Coals, Cannelton Cannel,

Also, SPLINT AND STEAM COALS,

From the Kanawha and New River Regions, on the line of the Chesapeake & Ohio R'way.

C. B. ORCUTT, General Agent, - - No. 1 Broadway (Room 217) New York City

EDMUND H. McCULLOUGH, Prest CHAS. F. GODSHALL, Treas. H. C. ADAMS, Sec.

THE WESTMORELAND COAL CO.

Chartered 1854.

Mines situated on the Pennsylvania and the Baltimore and Ohio Railroads, in Westmoreland County, Penn.

POINTS OF SHIPMENT:

PHILADELPHIA, BALTIMORE, SOUTH AMBOY, N. J.
WATKINS (SENECA LAKE), N. Y.

Since the commencement of operations by this Company its well-known Coal has been largely used by the Gas Companies of New England and the Middle States, and its character is established as having no superior in gas-giving qualities, and in freedom from sulphur and other impurities.

Principal Office, 224 South 3d St., Phila., Pa

THE CLERK GAS ENGINE CO.,

Main Office, 1012, 1014, 1016, 1018 Filbert St., Philadelphia, Pa.

WM. W. GOODWIN, Prest. E. STEIN, Sec.

The utility and convenience of the Gas Engine being no longer an open question, it only remains now for intending purchasers to select the BEST. We claim for the CLERK GAS ENGINE that it is equal to any other manufactured as regards steadiness in runn ng, simplicity, and ease of keeping in repair, and that it gives the greatest amount of power for the least money (both in first cost and expense of running) of any engine made. In support of this claim we refer to the test of the Gas Engines made under the direction of the American Institute of New York in December, 1885, and heretofore published in these columns. These engines are especially adapted for continuous running under heavy loads, and we can refer to Engines which have run 22 hours a day for months at a time.

Made in Sizes of 5 10, 15, 20, and 25 Horse Power. All Engines Guaranteed for One Year.

JOHN J. GRIFFIN & CO.,

Nos. 1513, 1515, 1517 & 1519 Race Street, PHILADELPHIA.
52 Dey St., NEW YORK. 75 N. Clinton St., (FRED. R. PERSONS, Mangr.) CHICAGO.

MANUFACTURERS OF

METERS FOR MEASURING GAS

IN ANY VOLUME.

Provers, Gauges, Registers, Etc., Etc.

EXPERIMENTAL APPARATUS FOR QUANTITATIVE AND QUALITATIVE ANALYSIS.

Careful and Prompt Attention paid to Repairing of all kinds of Meters and Apparatus.

Estimates Cheerfully Furnished.

Dry Gas Meters.

With 40 years' experience and the best facilities for manufacturing, is enabled to furnish reliable work and answer orders promptly.

NATHANIEL TUFTS,

No. 153 Franklin Street, Boston, Mass.,

MANUFACTURER OF

DRY GAS METERS.

Station Meters of any Capacity.

Test and Experimental Meters, Pressure Registers, Pressure Gauges, Pressure and Vacuum Gauges.

METER PROVERS, PHOTOMETERS, STREET LANTERNS, ETC., ETC.

Patent Cluster Lanterns for Street Illumination.

CHARLES E. DICKEY. JAMES B. SMALLWOOD. CHARLES H. DICKEY.

THE MARYLAND METER AND MANUFACTURING CO.

Established 1866.

BALTIMORE, North & Saratoga Sts. **CHICAGO, 122 & 124 Michigan St.**
NEW YORK, 838 Broadway. **SAN FRANCISCO, 221 Front St.**
BOSTON, 92 Water Street, Rooms 21 and 22.

CONSUMERS' & STATION METERS, PRESSURE GAUGES, Etc., Etc.

"Success" and "Perfect" Gas Stoves.

A. HARRIS. E. L. HARRIS. J. A. HARRIS.

Established 1849.

HARRIS BROS. & CO.,

Twelfth and Brown Streets, Philadelphia.

Manufacturers of Wet and Dry Gas Meters,

STATION METERS, METER PROVERS,

EXPERIMENTAL METERS, SHOW OR GLAZED METERS,

Pressure and Vacuum Registers, Gauges, Photometers, Drip and Bell Pumps, Etc., Etc.

PROMPT ATTENTION GIVEN TO ALL ORDERS. METERS THOROUGHLY REPAIRED. ESTIMATES FURNISHED FOR STATION METERS OF ALL SIZES. CORRESPONDENCE SOLICITED.

GAS METERS. GAS METERS. GAS METERS.

GEO. J. McGOURKEY, Prest. WM. H. McFADDEN, Vice-Prest. (Phila.) WM. N. MILSTED, Gen. Supt. and Treas. (New York). WM. H. DOWN, Sec.

THE AMERICAN METER CO.

Established 1834. Incorporated 1863.

WET AND DRY GAS METERS. PRESSURE REGISTERS. METER PROVERS.
STATION METERS. PRESSURE & VACUUM REGISTERS. PORTABLE TEST METERS.
EXHAUSTER GOVERNORS. PRESSURE & VACUUM GAUGES. EXPERIMENTAL METERS.
DRY CENTER VALVES. CRESSON GAS REGULATORS. AMMONIA TEST METERS.
GOVERNORS FOR GAS WORKS. MARSLAND WATER METERS. BAR & JET PHOTOMETERS.

Manufactories:
512 West 22d St., N. Y.
Arch & 22d Sts., Phila.

GAS STOVES.
SUGG'S "STANDARD" ARGAND BURNERS,
SUGG'S ILLUMINATING POWER METER,
Wet Meters, with Lizar's "Invariable Measuring" Drum.

Agencies:
[illegible] Elm Street, Cincinnati.
[illegible] N. Wells Street, Chicago.
810 North Second Street, St. Louis.
222 Sutter Street, San Francisco.

HELME & McILHENNY,

(Established 1848.)

GAS METER MANUFACTURERS,

Nos. 1339 to 1349 Cherry Street, Philadelphia, Pa.,

WET AND DRY GAS METERS, STATION METERS, EXPERIMENTAL METERS, METER PROVERS,

Center Seals, Pressure Registers, Governors, Indicators, Photometers, and all other kinds of Apparatus for use in Gas Works.

FOULIS' PATENT STATION AND DISTRICT GOVERNORS.

REPAIRING DEPARTMENT.—We employ a special force of skilled workmen repairing meters of **all makers.**

D. McDONALD & CO.,

GAS METER MANUFACTURERS.

(Established 1854.)

51 Lancaster St., Albany, N. Y. 34 & 36 West Monroe St., Chicago, Ill.

STATION METERS, EXPERIMENTAL METERS, METER PROVERS, PRESSURE & VACUUM REGISTERS, PRESSURE GAUGES, ETC.

We use only the very best materials, and employ the most skilled labor, and by our long experience (37 years) and personal supervision of every deta we feel justified in assuring the public that our goods will give perfect satisfaction. Every Meter emanating from our establishment will bear the Sta Inspector's Badge, and will be fully warrented by us. Our Annual and Calendar will be sent to Gas Companies upon applicatior.

Other people have found us to
their advantage.
We'll be glad to serve you.

STATION METERS.
METER PROVERS.
CONSUMERS' METERS.
REPAIRING.